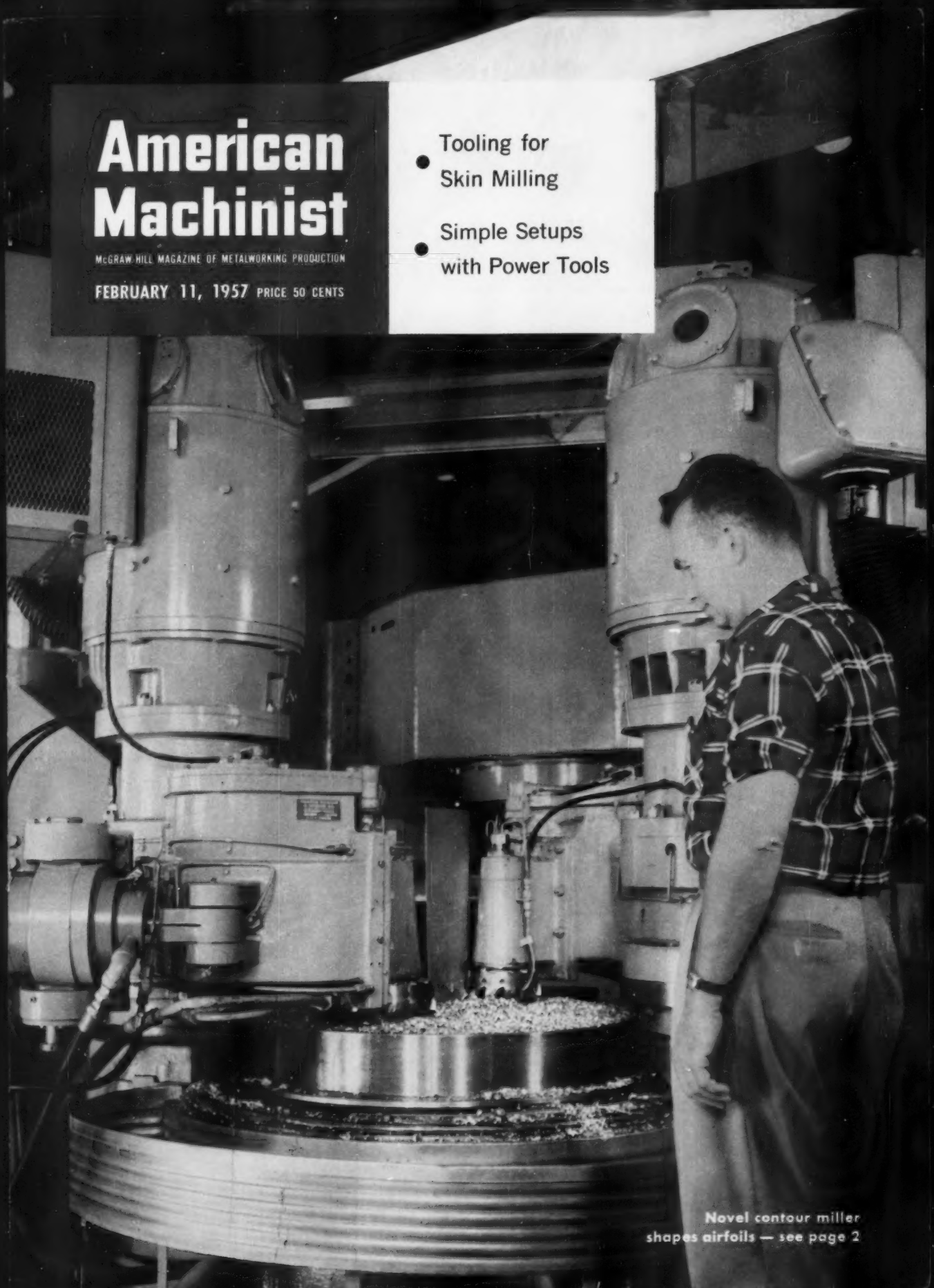
American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

FEBRUARY 11, 1957 PRICE 50 CENTS

- Tooling for Skin Milling
- Simple Setups with Power Tools



Novel contour miller shapes airfoils — see page 2

AUTO-INDEXING permits

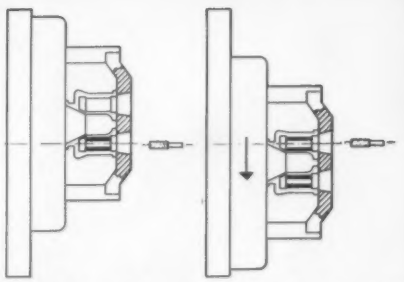
single chucking for double bore grinding

Manually re-locating a part to grind a *second* bore takes valuable operator time. This time can be saved, in many instances, by the use of an auto-indexing fixture on a Heald Internal Grinder. For example, the Model 271 Size-Matic shown below precision grinds *two* interrupted bores in a universal joint body in a single, fully automatic, 71-second cycle.

The diagrams at right show how both bores of the work are brought in line with the grinding wheel — automatically!

This auto-indexing feature can be used for many two-bore grinding jobs of this type with substantial savings in handling time and more precise alignment of the finished surfaces.

IT PAYS TO COME TO HEALD!



Auto-indexing fixture in position for grinding first bore.

Rotary cross-feed unit indexed to position for grinding second bore.

HEALD

THE **HEALD** MACHINE COMPANY

Worcester 6, Massachusetts

Subsidiary of The Cincinnati Milling Machine Co.

® Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

American Machinist

METALWORKING PRODUCTION

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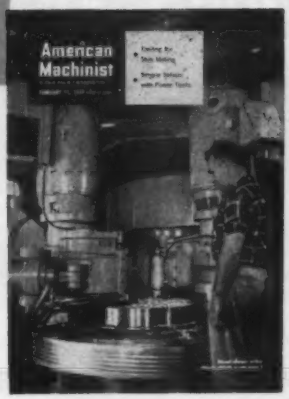

Cover . . .
Three-dimensional airfoil milling machine, built for NACA by Danly, makes both rough and finish cuts in a single pass. The machine is described in detail on page 104.

Russian Report . . . Another in our startling series of on-the-spot reports from Russia gives a detailed report on three new machine-tool building plants. You will be surprised both by their lack of inspection and the way they are standardizing models and putting them on an assembly line. However, the methods do not approach the degree of automation we found in the bearing plant we described last month (*AM*—Jan 14 '57, p147).

Ultrasonic Deburring . . . The problem of microscopic burrs on precision parts can be solved by adapting the ultrasonic cleaning method to do the deburring. Associate Editor John Wright has assembled a series of case studies to demonstrate what can be done. His major problem was to find a way to photograph the tiny parts that would bring out the before-and-after differences. Our photo studio was in an uproar as one method after another was tried. Hans Basken, studio director, and John would try a rig, then rush into the darkroom to see how it came out. They had many failures before they produced the fine set of pictures you will see starting on page 129. The final series was taken (see picture below) through a microscope borrowed from our Medical Department. The microscope was 10X in the objective (lower lens) with a 5X eyepiece giving 50X pictures. Major problems were to get enough light on the parts and to keep vibration from throwing the setup out of focus. The pictures are published without any retouching and we assure you that you are looking at burrs—not dirt. All of the parts were thoroughly cleaned before photographing.

Coming . . . *AM* for Feb 25 will lead off with an improved method of determining minimum bend radii for brake forming. The Special Report will summarize ways to apply modern management methods to the small shop. There will be articles on such hot subjects as industrial television, spontaneous combustion in metals, and superalloys. Among other articles will be a report on an ultrasonic micrometer, a method of ribbing magnesium while drawing it, and an evaluation of solid carbide boring bars.

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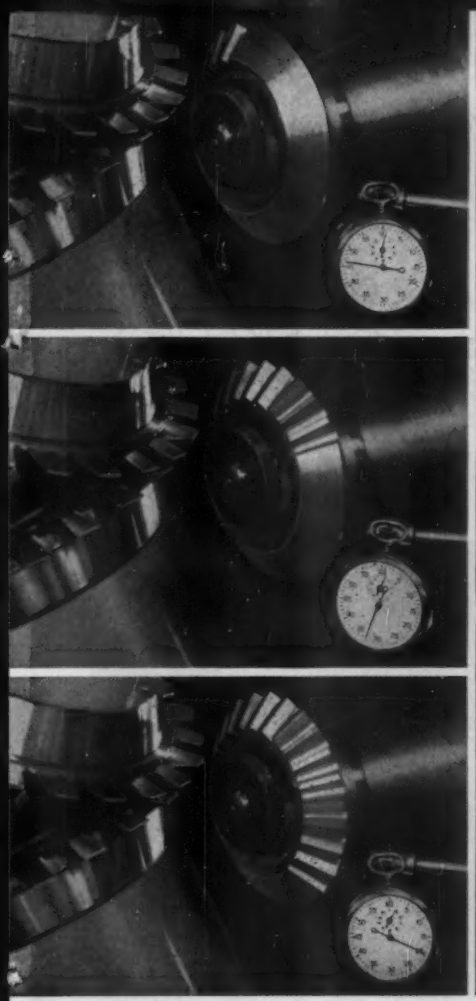


3 minutes-52 seconds, completed from the solid

You can cut gears 5 times faster!

You can increase production by as much as 400%.

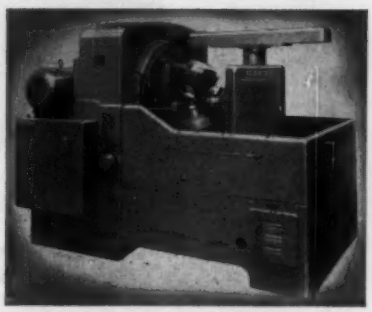
Your exact gain may vary with different gears, but in most cases this new generator will complete five gears in the time earlier models cut just one. The illustrations above show a 6 DP, 25 tooth, 7/8" face width, straight bevel gear completed from the solid blank.

The No. 104 Straight Bevel Coniflex* Generator completes each tooth in one rapid operation. A pair of multi-blade disc-type cutters combined with a cam-controlled machine cycle insures high efficiency, fine finish and maximum cutter life.

Easy to set up, the No. 104 has a wide range of capacity. You'll get the same excellent results for both small quantity jobbing work and volume production.

To discover other savings you can make with this remarkable Gleason Generator, simply write for descriptive bulletin.

*Coniflex® straight bevel gears with localized tooth bearings.

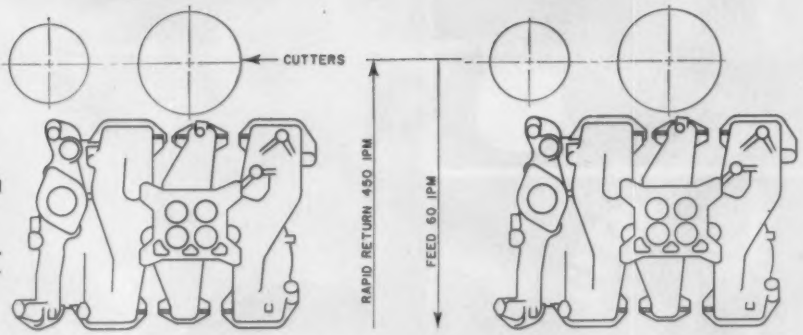


The Gleason No. 104 Straight Bevel Coniflex Generator cuts gears up to 8½" diameter, 4½" cone distance and 1⅜" face width, from 20 to 3 DP, ratios up to 10 to 1.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.



Work flow drawing for CINCINNATI® 4-Station Automatic Transfer Machine.

Production Data

Part Name ..... Intake Manifold

Material ..... Cast Iron

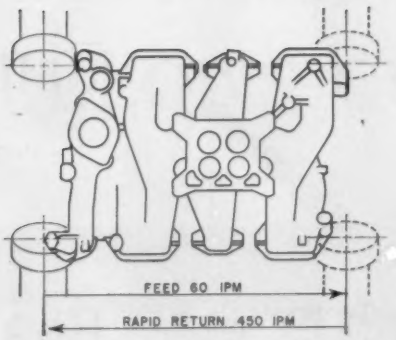
Operations .. Mill 25° angular mounting pads and 5° accessory pads

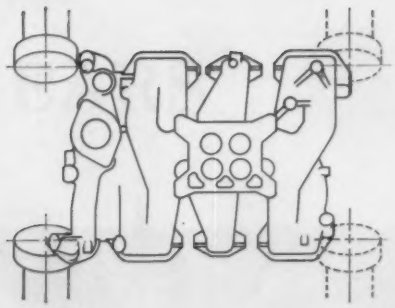
Production .. 160 manifolds per hour

CINCINNATI

CINCINNATI

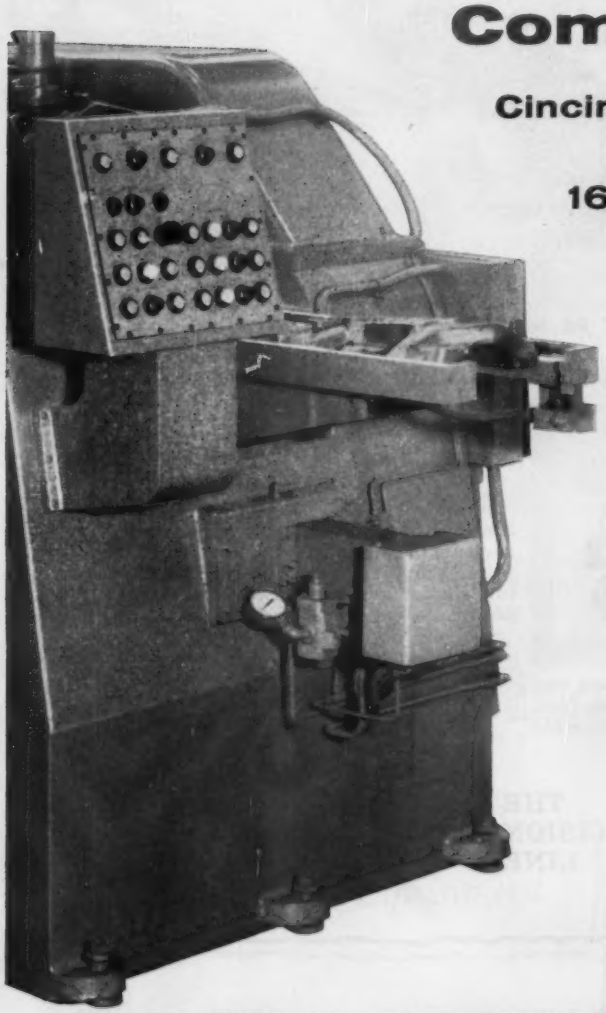
MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES





Compact...Simplified

Cincinnati 4 Station Transfer Machine
Automatically Mills
160 Intake Manifolds per hour



Straight-line progression of work reduces floor space required for transfer type machines; simplifies the transfer mechanism. Cincinnati Milling Specialists incorporated these advantages in the 4-Station Manifold Milling Machine illustrated here . . . there are no rollover or turntable units. The work progresses through four stations in a straight line. To attain this advantage, the spindles for the milling operations in stations 1 and 2 are mounted upside-down (see work flow drawing). Other advantages:

Hardened and ground ways . . . automatic lubrication

Center opening in bed for easy chip disposal

Fast rapid traverse at 450" per min., and feed rates up to 150" per min.

Cincinnati Special Machine Tool Division has the engineering experience and product background to give you the finest single-purpose, automated equipment available anywhere. Our automation specialists will be glad to investigate your methods and production procedures, and tell you how costs can be reduced. May we hear from you? Please enclose blueprints and complete details.

Special Machine Tool Division
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

POWER to build delivered

Lorain-56 Shovel-Crane is 1¼ yard shovel, 25-ton crane, or 30-ton crane as desired, features torque converter to absorb working shocks and stresses, 2-lever air controls for easier operation.

Lorain Moto-Cranes* combine speed, power and versatility available in a range of lifting capacities from 7 to 75 tons. Multiple speed transmission, multiple big tires provide exceptional off-road mobility.

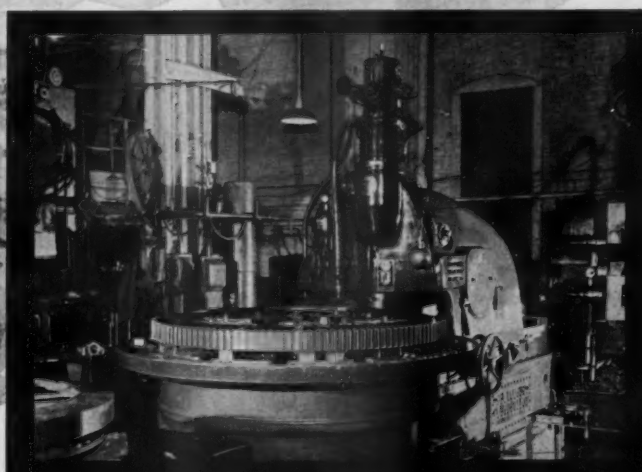
THE PRECISION LINE

Fellows

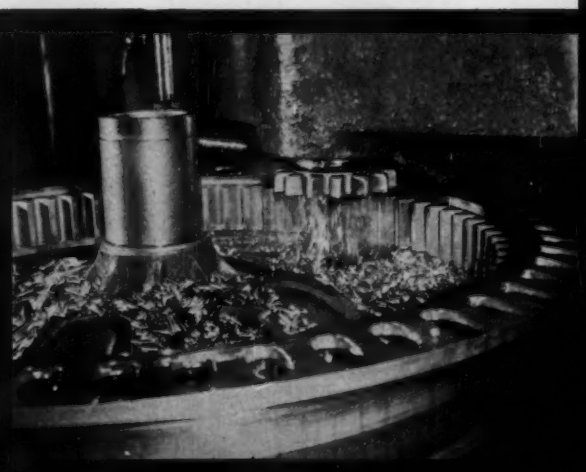
*Reg. U.S. Pat. Off.

America's Highways...

by FELLOWS-CUT GEARS



120-Inch Gear Shaper set-up for 138-tooth cast steel gear of 290-330 Brinell, 5" face width, 1.783 C.P., 1.180" total depth of cut. Four cuts—1181 min. approx.



100-Inch Gear Shaper cutting 73-tooth internal gear, 3½" face width, .8235 D.P., 1.007" depth of cut. Material—steel casting 197-235 Brinell. One cut—320 min. approx.

The machines that move mountains of material for America's highway programs demand good, rugged, smooth running gears that will transmit, without failure, the many tons of force required.

The well known Thew Shovel Company of Lorain, Ohio is one of the major construction equipment makers that use Fellows machines to produce these gears. The largest Thew-Lorain gears require the largest capacity Gear Shapers in the Fellows Line, the 100-Inch and the 120-Inch.

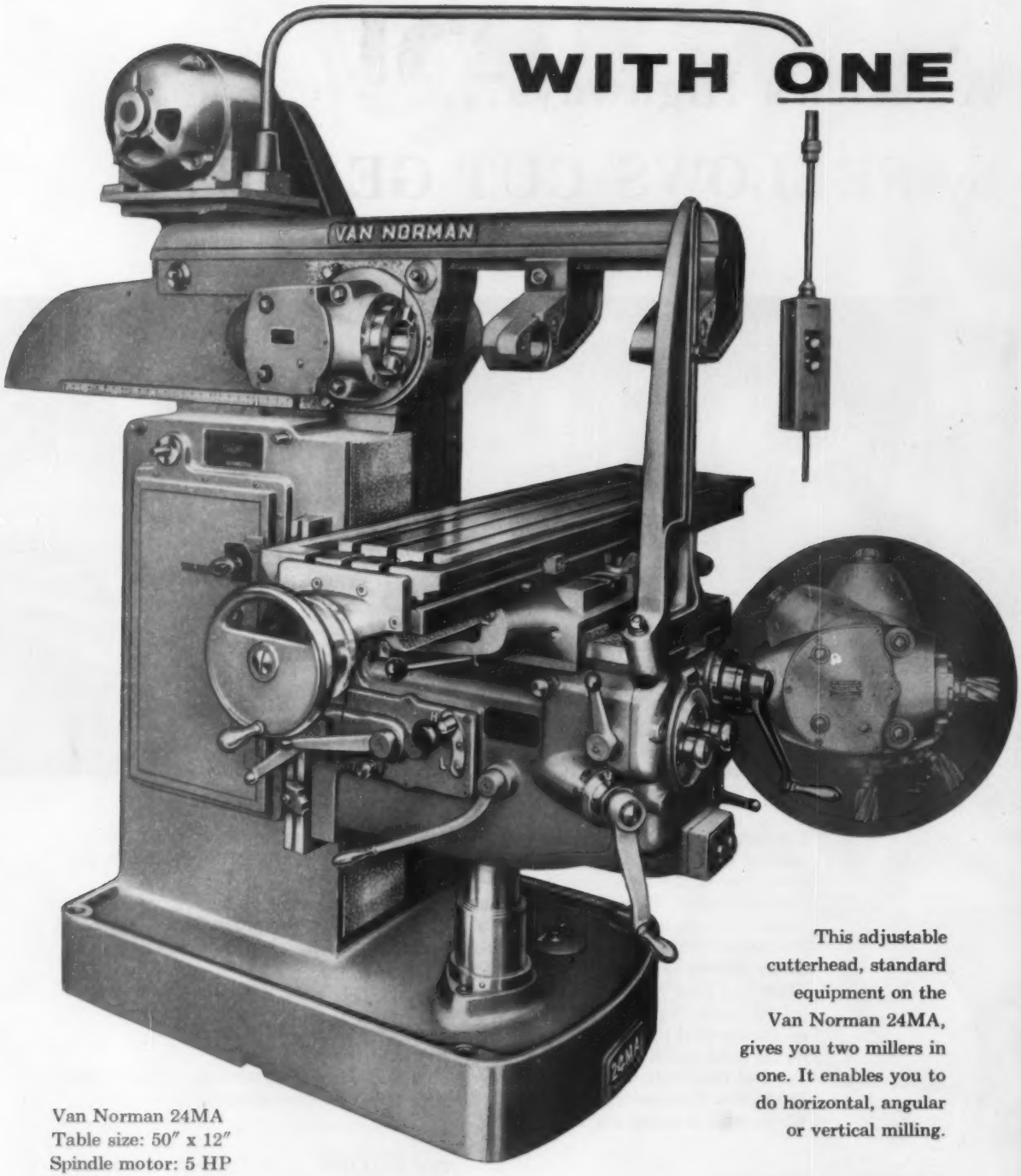
These two Gear Shapers are designed to take heavy cuts at coarse feeds on spur or helical gears. Capacities: 28" to 100" for externals and 46" to 100" for internals on the 100-Inch; 28" to 120" for externals and 46" to 120" for internals on the 120-Inch. Maximum face width on each is 8".

For *full* information about the complete Precision Line of cost-cutting Fellows Gear Production Equipment get in touch with your Fellows representative. Write, wire or phone any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N.J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Gear Production Equipment

WITH ONE



This adjustable cutterhead, standard equipment on the Van Norman 24MA, gives you two millers in one. It enables you to do horizontal, angular or vertical milling.

Van Norman 24MA
Table size: 50″ x 12″
Spindle motor: 5 HP
Speeds: 12
Feeds: 12

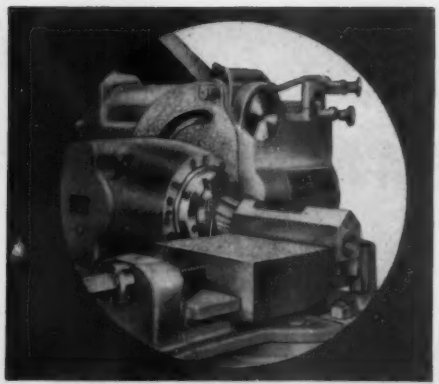
VAN NORMAN MACHINE

SUBSIDIARY OF VAN NORMAN INDUSTRIES, INC.

Manufacturers of — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

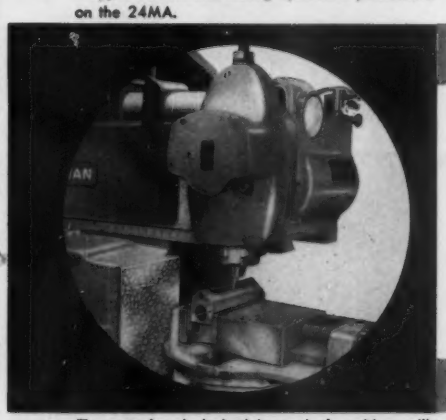
VAN NORMAN

RAM-TYPE MILLER YOU CAN DO...



A typical horizontal milling operation performed on the 24MA.

HORIZONTAL MILLING



The cutterhead, locked in vertical position, mills a slot in the workpiece.

VERTICAL MILLING

With cutterhead in angular position the same piece is milled without disturbing setup.

ANGULAR MILLING

WITHOUT ATTACHMENTS

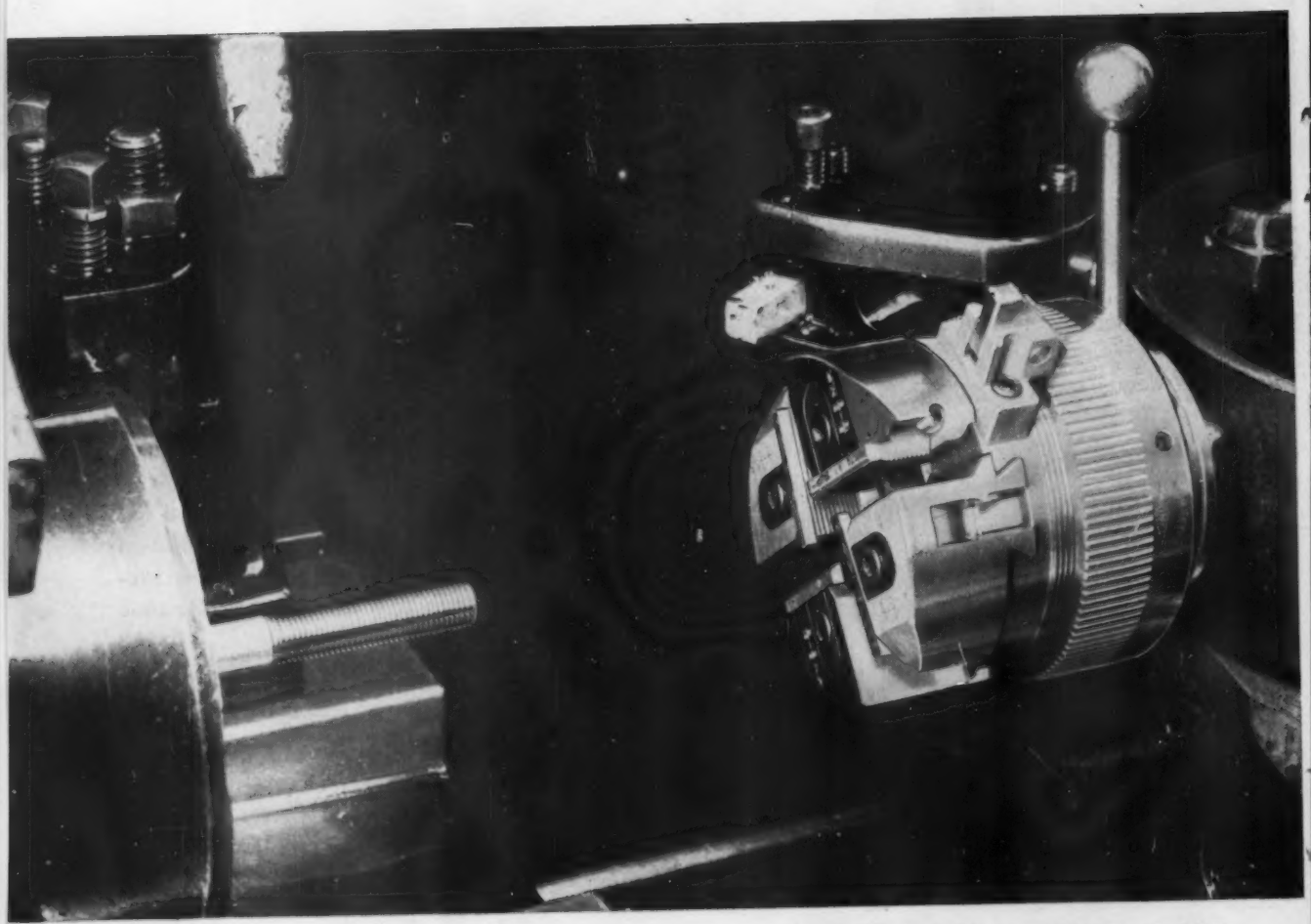
One investment in *one* Van Norman ram-type miller gives you the equivalent of two conventional machines plus attachments. In addition to important savings on the investment, you also get big dollar savings through reduced work setups, idle machine and operator time and increased production.

Get complete details on the Van Norman 24MA, or on any of the many Van Norman ram-type millers. Write, wire or telephone for catalog.

Don't wait . . . for extra profit install a Van Norman machine now! They are available on many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years.

COMPANY
SPRINGFIELD 7
MASSACHUSETTS

CONCENTRICITY



HELD TO .002"

between workpiece O.D. and thread with **LANDIS** *Die Head*

Centering Throat Chasers enabled the LANDMATIC Head to solve a difficult threading problem at the Minneapolis-Honeywell Regulator Co., Valve Division, in Philadelphia, Pa.

Threads on valve stems for diaphram control valves were required to meet a concentricity tolerance of .002" total indicator reading. The 5HH LANDMATIC Hardened and Ground Head using Centering Throat Chasers is the only head tested capable of producing these results.

The Centering Throat Chasers used in this operation are specifically designed for producing threads requiring a high degree of concentricity with the outside diameter of the workpiece. Thus they are particularly adapted for cutting long thread lengths where there is a tendency of the workpiece to run out-of-round.

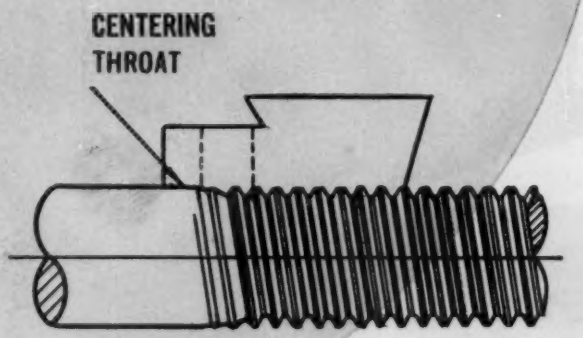
As indicated on the drawing, the centering throat section is allowed to protrude from the chaser cutting edge. This projection varies from $\frac{1}{8}$" for the coarse pitch threads to $\frac{1}{16}$" for the finer pitches. No cutting action takes place on this section of the chaser as it extends over the rotational centerline of the workpiece and only acts as a work aligning and supporting surface.

To produce these stems, $\frac{3}{8}$" 24-pitch UNF threads are cut $1\frac{5}{16}$" long on 316 stainless steel.

Cutting at 30 SFM the 5HH LANDMATIC Head mounted on #2 B & S Hand-Operated Screw Machine, produces these threads to *Class 3 tolerances.* Entire lots of 400 pieces are run without regrinding the chasers.

The LANDMATIC Hardened and Ground Head is a stationary head, designed and built to give the great rigidity required for precision threading. It is available in a variety of sizes for producing threads from $\frac{1}{16}$" to 2" in diameter, and uses the LANDIS Tangential Chaser which may be reground and used for 80% of its original length.

For detailed information, write for Bulletin F-80 — please include specifications.



LANDIS *Machine* **COMPANY** | WAYNESBORO PENNSYLVANIA

473C

Exclusive features of Landis universals cut grinding and setup time for short runs

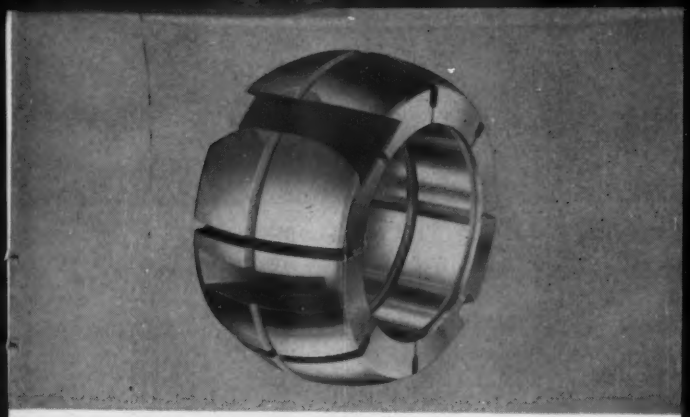
. . . fully universal grinder saves time on precision grinding operations
. . . speeds setup changes

Landis 12" x 36" Type CH Precision Universal Grinder

LANDIS

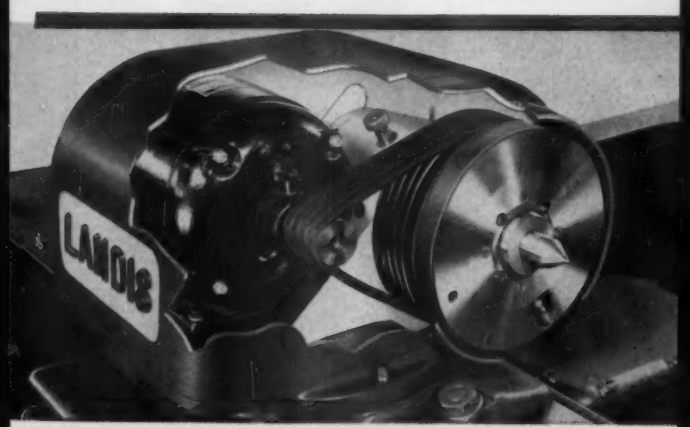
precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA



1 Landis Microsphere Bearings
Closest running clearance of any type spindle bearing gives finest finishes.

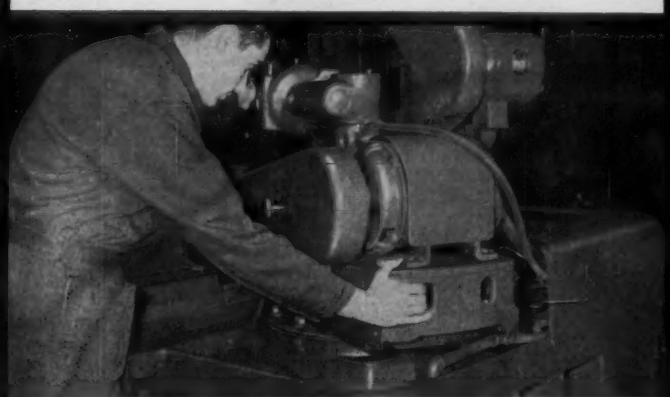
2 Eye-Level Wheel Feed
Operator can see both grinding operation and handwheel graduations.



3 Variable Speed Headstock
Low, compact headstock. Only two revolving parts. Speed regulated by a rheostat control.

4 Swinging Type Internal Grinding Fixture
Quick changeover, accurate and rigid. No exposed belts. Swings up out of the way.

5 Rapid Hydraulic Wheel Positioning
Saves setup time by rapidly advancing or retracting wheelhead. (Extra equipment.)



6 Universal Wheelhead Swivel
Easy hand swiveling of wheelhead—without bars—saves time when setups are frequent.

GIDDINGS & LEWIS
62-inch HYPRO
openside planer

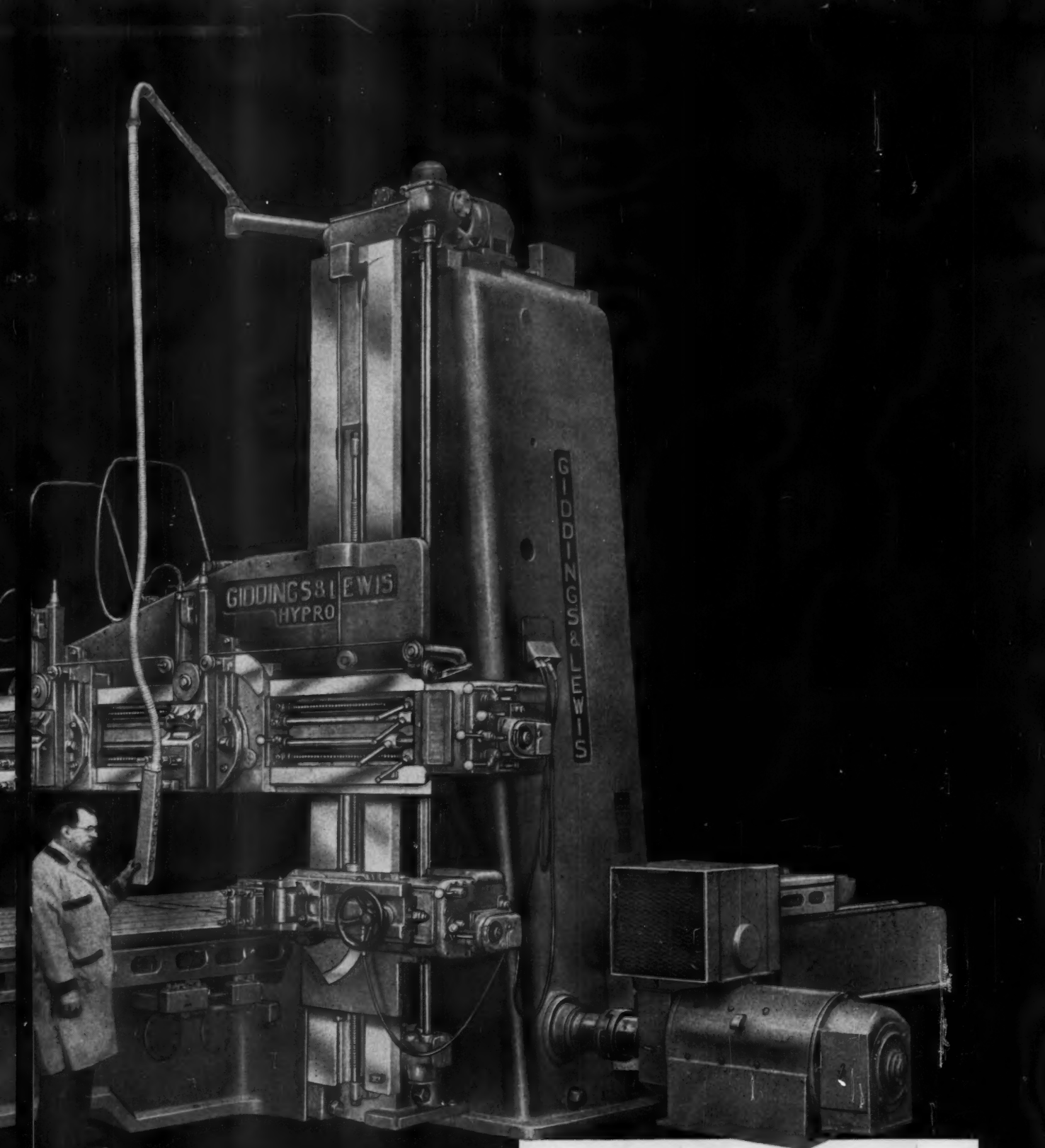
EVERYTHING you've ever wanted for precision, high-speed tungsten-carbide planing of large and cumbersome workpieces — yours in this modern, heavy-duty 62″ HYPRO openside planer.

RUGGED one-piece knee — all the way across — adds rigidity and support to the cross rail, permitting independent use of either head for planing over maximum width of table.

Advanced construction features assure vibrationless, precision planing. They include centralized dual controls, power-swiveling and counter-balanced heads, twin helical gear table drive, machine bed that's double length of table. HYPRO openside planers are offered in 12 models with a broad range of table capacities from 36″ thru 96″ wide and any required length . . . main motor drives of 25/50 thru 100/200 hp . . . a choice of one, two or three heads. Auxiliary housing and supplemental rolling table are also available.

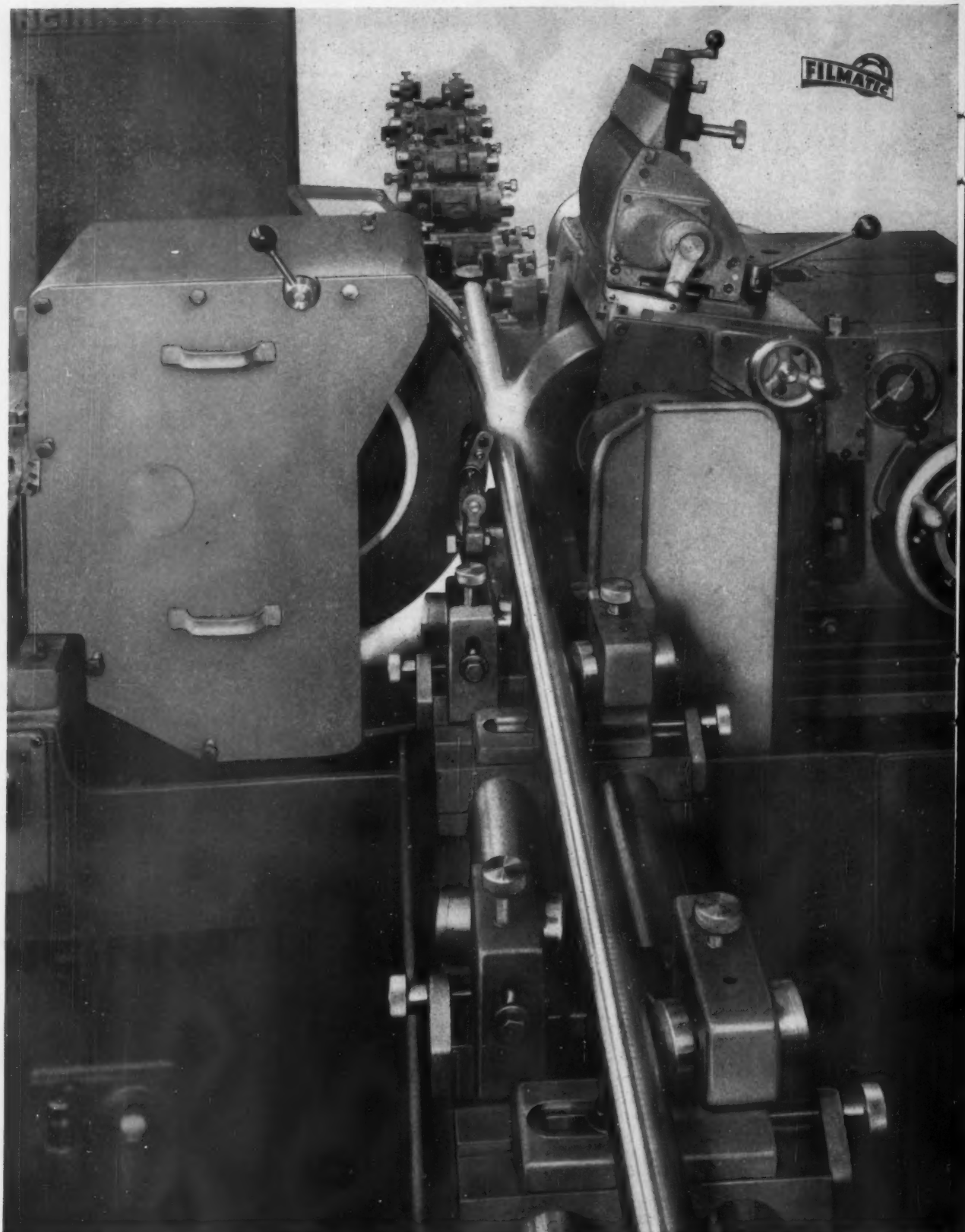
For more information on G&L's complete line of HYPRO openside or double housing planers, see your nearest Giddings & Lewis representative, or write direct.

LITERATURE AVAILABLE:
For complete specifications on Giddings & Lewis HYPRO openside planers, write for Bulletin No. 225.



G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN G-72

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.



CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

Cincinnati Filmatic No. 3's ...Make Your Tough Centerless Grinding Jobs Look Easy and Cost Less

Solid steel bars, up to 4" diameter x 18 feet long, are ground on a CINCINNATI FILMATIC No. 3 Centerless Grinding Machine equipped with Type D Long Bar Grinding Attachment.

Up to 20" lengths can be infeed ground in one pass on new CINCINNATI FILMATIC No. 3 Centerless Grinding Machines. In the setup above, 4, 5 or 6 diameters, within overall lengths of 16½", are infeed ground on stainless steel bolts.

Thrufeed grinding 4" steel bars, or infeed grinding multiple diameter spindles up to 20" long are tough jobs for any centerless. CINCINNATI® FILMATIC No. 3's make these jobs, and thousands of in-between sizes and shapes, look easy and cost less. The No. 3's are extra powerful to give you extra productive capacity combined with Cincinnati's well-known dependability of performance. Contributing factors to these desirable elements of low production costs include:

1) **Fixed bedrock mounting of the grinding wheel spindle for fast, economical grinding**
2) **FILMATIC grinding wheel spindle bearings for highest quality performance and zero maintenance. They're self-adjusting for every job**
3) **Pre-loaded, precision anti-friction regulating wheel slide, for super-precise size control**
4) **Infinitely variable regulating wheel speeds ranging from 10 to 320 rpm, for quick selection of the correct speed**
5) **Automatic grinding wheel balancing (supplied at extra cost)**

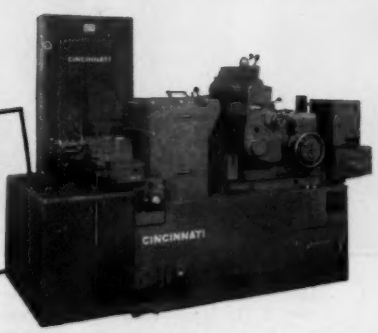
Eleven additional features and their relation to the proved dependability and productive capacity of CINCINNATI FILMATIC No. 3 Centerless Grinders are outlined in catalog No. G-664-1. Ask for a copy today. You will find brief data in Sweet's Machine Tool File.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CINCINNATI

CINCINNATI

CINCINNATI FILMATIC No. 3
Centerless Grinding Machine
Catalog No. G-664-1



GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

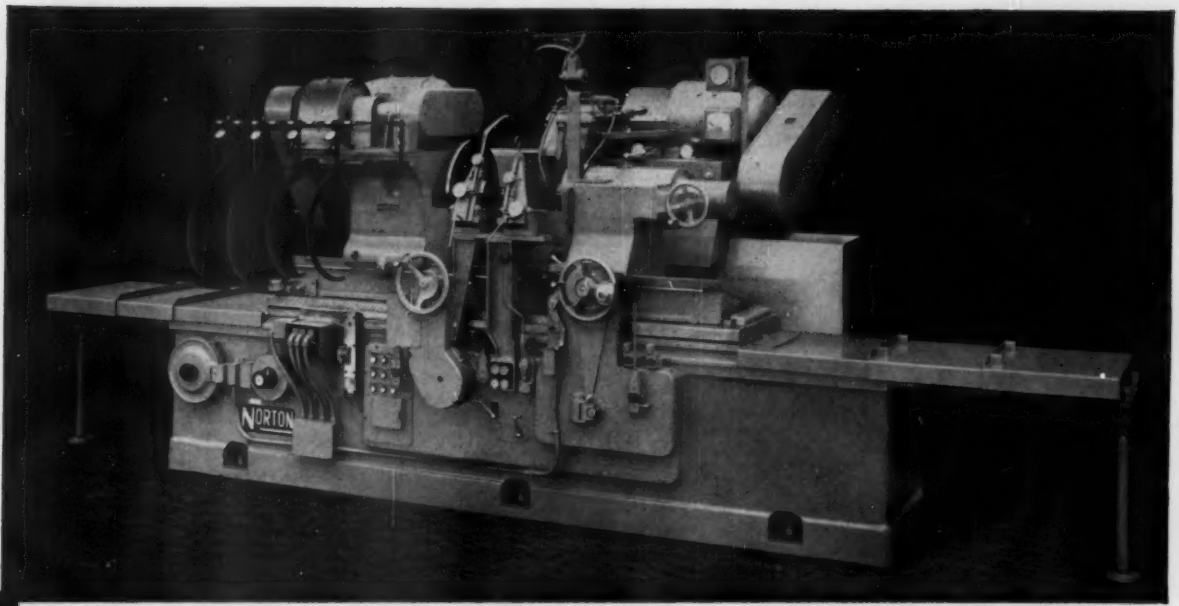
Newest Norton Grinder!...

The 30" Type LCTU Semiautomatic...

...a production-booster for grinding large-diameter parts...

a profit-booster for YOU

Every Feature For Fast, Accurate, Automatic Grinding of large-diameter, relatively light parts is built into the new Norton 30" Type LCTU Semiautomatic Cylindrical Grinder. It gives you the "Touch of Gold" by adding value to the parts it grinds and by increasing your production rate and profit margin. All controls are within easy reach of the operator and special job-easing equipment reduces his work and increases your production. This ultra-modern grinder is available in work lengths of 48" 72" and 96".



The new Norton 30″ Type LCTU Semiautomatic Cylindrical Grinder is expertly engineered to improve your grinding operations on ***large-diameter parts of relatively light weight.***

It does this by bringing you maximum speed, accuracy, operating ease and economy — typical Norton "Touch of Gold" advantages that mean top-quality, lowest cost production.

Advanced Features

- Automatic grinding cycle, under one-lever control, assures fast, consistent output and reduces operating effort. Electrically timed termination of the cycle can be shifted to manual control.
- Start-stop of work rotation and coolant flow controlled automatically with the grinding cycle or manually, as desired.
- The rugged wheel spindle and sturdy work supporting units combine with the precision wheel feed mechanism to produce fast die-out with exceptional repetitive accuracy in sizing.
- Pre-set speed control permits separate table speeds for truing and grinding as set from the first workpiece. Thereafter, either speed is instantly provided by moving the table control lever.
- All controls for feeds and speeds easily accessible from front of machine. Automatic or manual wheel feed settings speeded by "click-count" index, enabling settings for work diameter reduction in increments as fine as .0001″. Handy work jogging lever permits fractional rotation of the work for most convenient loading or inspection.

Many Accessories

are available to increase the efficiency of the 30″ Type LCTU for special jobs. Optional extras include locating devices, automatic wheel truing, automatic compensation of wheel head setting after truing and a lever-operated device for moving the grinding wheel into a shoulder to be ground.

To Meet Your Competition

Obsolete grinding equipment is a business risk. Why not get all the facts on how the new, highly advanced 30″ Type LCTU Grinder can aid in improving your competitive position? See your Norton Representative or write direct. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass.

District Offices:
Worcester • Hartford • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

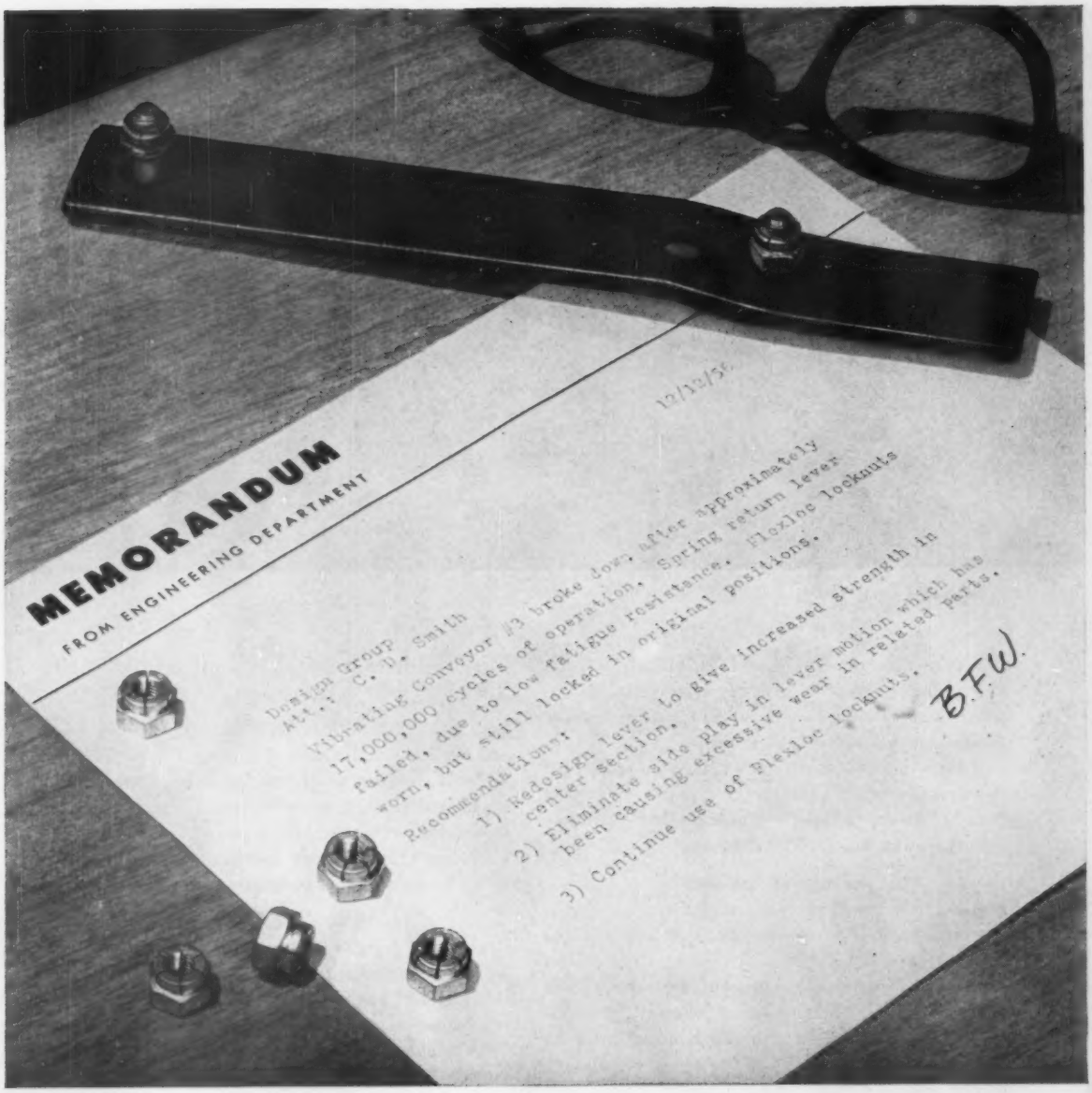
To Economize, Modernize with **NEW**

NORTON

GRINDERS and LAPPERS

Making better products...to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes


MEMORANDUM
FROM ENGINEERING DEPARTMENT
12/12/56
Design Group
Att.: C. D. Smith
Vibrating Conveyor #3 broke down after approximately
17,000,000 cycles of operation. Spring return lever
failed, due to low fatigue resistance. Flexloc locknuts
worn, but still locked in original positions.
Recommendations:
1) Redesign lever to give increased strength in
center section.
2) Eliminate side play in lever motion which has
been causing excessive wear in related parts.
3) Continue use of Flexloc locknuts.
B.F.W.

Why designers specify FLEXLOC self-locking nuts

Where products must be tough . . . must stand up under vibration, shock and abuse . . . designers specify rugged, reliable, precision-built FLEXLOC self-locking nuts as fasteners.

HERE'S WHY:

FLEXLOC locknuts are strong: tensile strengths far exceed accepted standards. They are uniform: carefully manufactured to assure accurate, lasting spring tension in the flexible locking collars. And they are reusable: rough screw threads, repeated removal and replacement, frequent adjustments will not affect their locking life.

Standard FLEXLOC self-locking locknuts are available in a wide range of standard sizes and materials, to meet the most critical locknut requirements. Your authorized industrial distributor stocks them. Write us for complete catalog and technical data. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

FLEXLOC® LOCKNUT DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

Bearing manufacturer grinds large and small parts with new Gardner Disc Grinder

grind **TWO** parallel surfaces in **ONE** operation

3 station rotary carrier with face cutting cycle

Continuously rotating carrier for small parts

2H30 Double Spindle Precision Disc Grinder

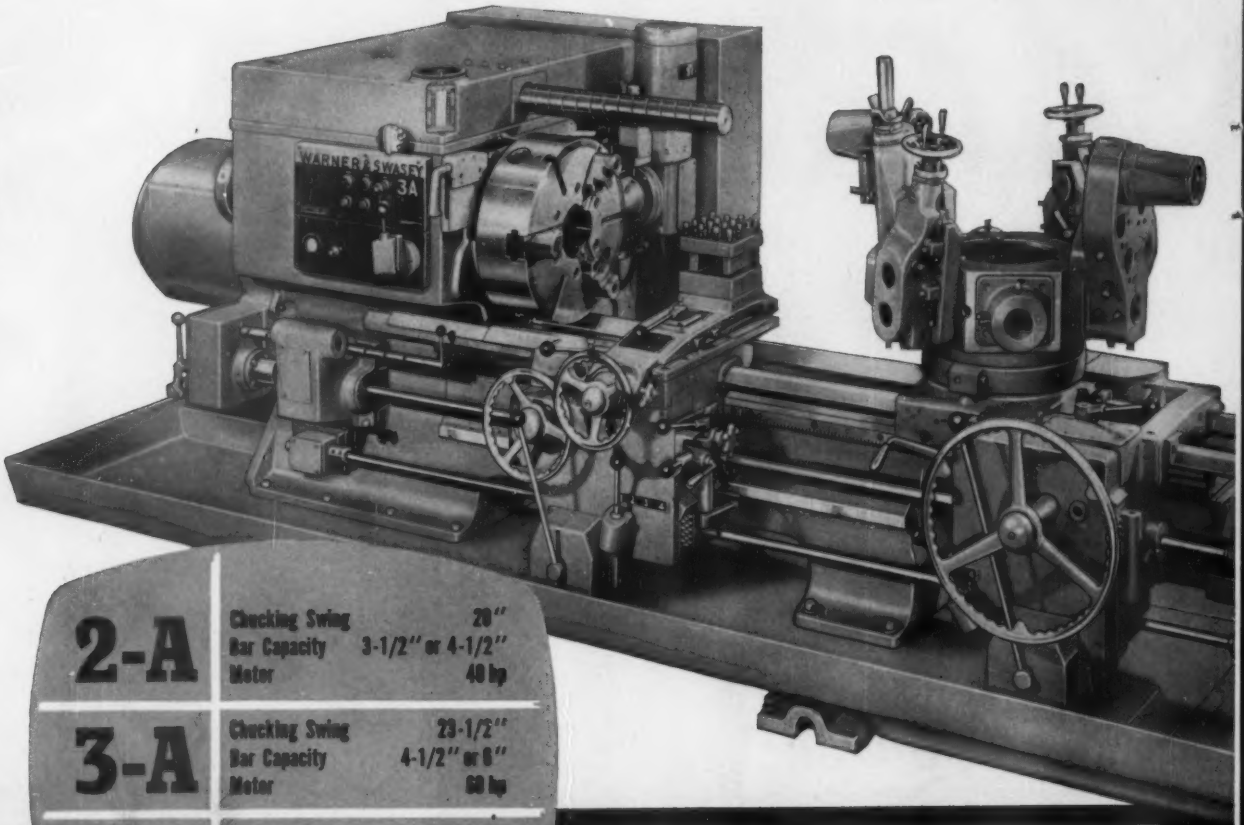
production data:	Races	Rollers
Size of workpiece	.504" Thick 6.508" O.D. 6.093" I.D.	1.25" long x 1.126" dia.
Production Rate: pieces per hour	100	600
Stock Removal: max. over-all	.010"-.012" per cut	.008"-.010"
Tolerances:		
Flatness and parallelism	.0002"	.0002"
Uniformity	.00015"	.001"
Squareness TIR	—	.0002"

. . . User reports continue to stress performance value of 2H30 . . . interchangeable work carriers permit quick change from job to job.

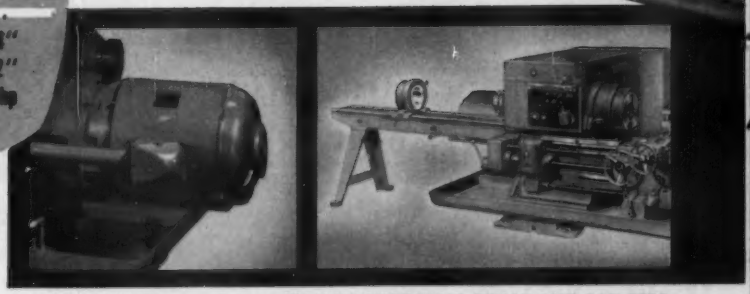
GARDNER

precision disc grinders

BELOIT, WISCONSIN

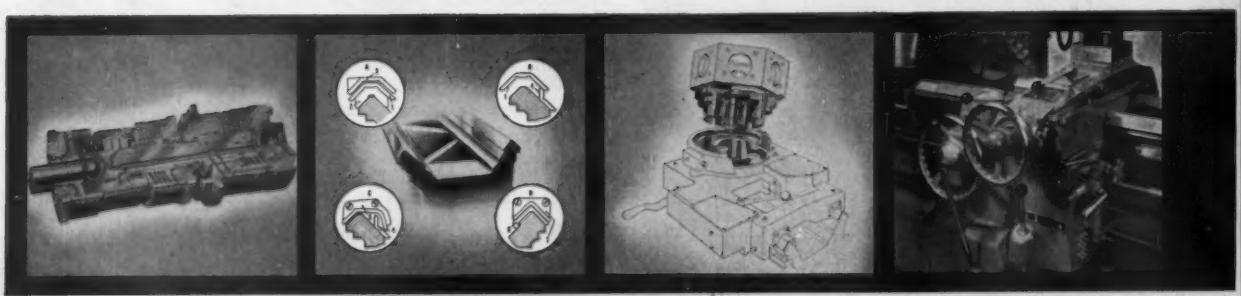


2-A	Chucking Swing	20"
	Bar Capacity	3-1/2" or 4-1/2"
	Motor	40 hp
3-A	Chucking Swing	23-1/2"
	Bar Capacity	4-1/2" or 6"
	Motor	60 hp
4-A	Chucking Swing	28-1/4"
	Bar Capacity	9" or 12"
	Motor	75 hp



MORE POWER—as much as you'll need for any job! Motors available up to 40 hp. on 2-A; to 60 hp. on 3-A; to 75 hp. on 4-A.

NEW HYDRAULIC CHUCK AND BAR FEED and power return. Provides easier handling, less operator fatigue—increased production.



MAINTENANCE-FREE, instant-acting forward and reverse clutch and head-brake unit never needs adjustment—engages smoothly and virtually instantaneously providing fast starts, stops, and reverses.

INDUCTION-HARDENED VEE-BEDWAYS assure long, accurate life. Exclusive way covers protect bearing surfaces from damage by dropped tools, chips, and loss of way lubrication.

ACCURATE LOCATING AND LOCKING HEX TURRET assures maintained accuracy. Single lever controls both locating and clamping of turret.

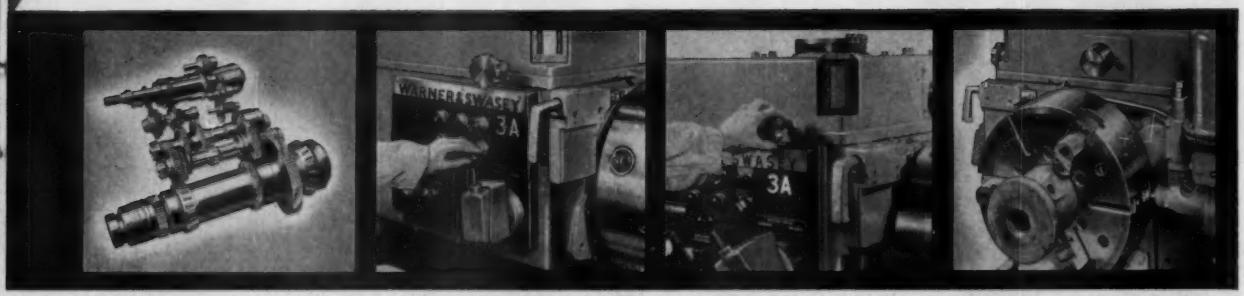
FAST OPERATING CROSS SLIDE. All controls within easy reach. 4-way traversing with rapid traverse lever. Monoshift lever provides fast feed changes. Open-type square turret for flexible tooling.

WARNER & SWASEY DESIGN FEATURES

give you increased efficiency,

greater production, more profits!

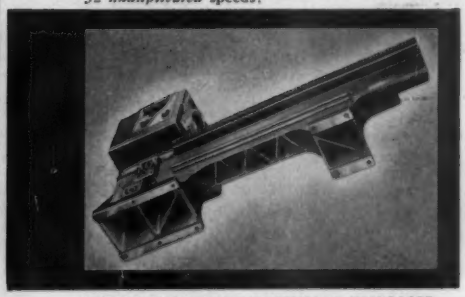
A 1-A model, with motors ranging to 30 hp., is available with an instantaneous shift, all-clutch headstock. It's provided with a 16¼" swing in either 2½ or 3-inch bar capacities.



16-SPEED DRIVE provides closer grouping of speeds in natural work range to turn more work diameters more effectively—increases production and tool life. 2-speed motor provides 32 *unduplicated* speeds!

SPEED PRESELECTION made easy by large, direct-reading indicator dial. AUTOMATIC GEAR SHIFTING boosts production, reduces operator fatigue. A single movement of the control handle without any further attention by the operator slows spindle to crawl speed, then shifts to new speed—all in a matter of seconds.

NEW POWER CHUCK WRENCH eliminates back-breaking effort when chucking. Grips and holds delicate work or heavy forgings. Does not obstruct spindle bore.



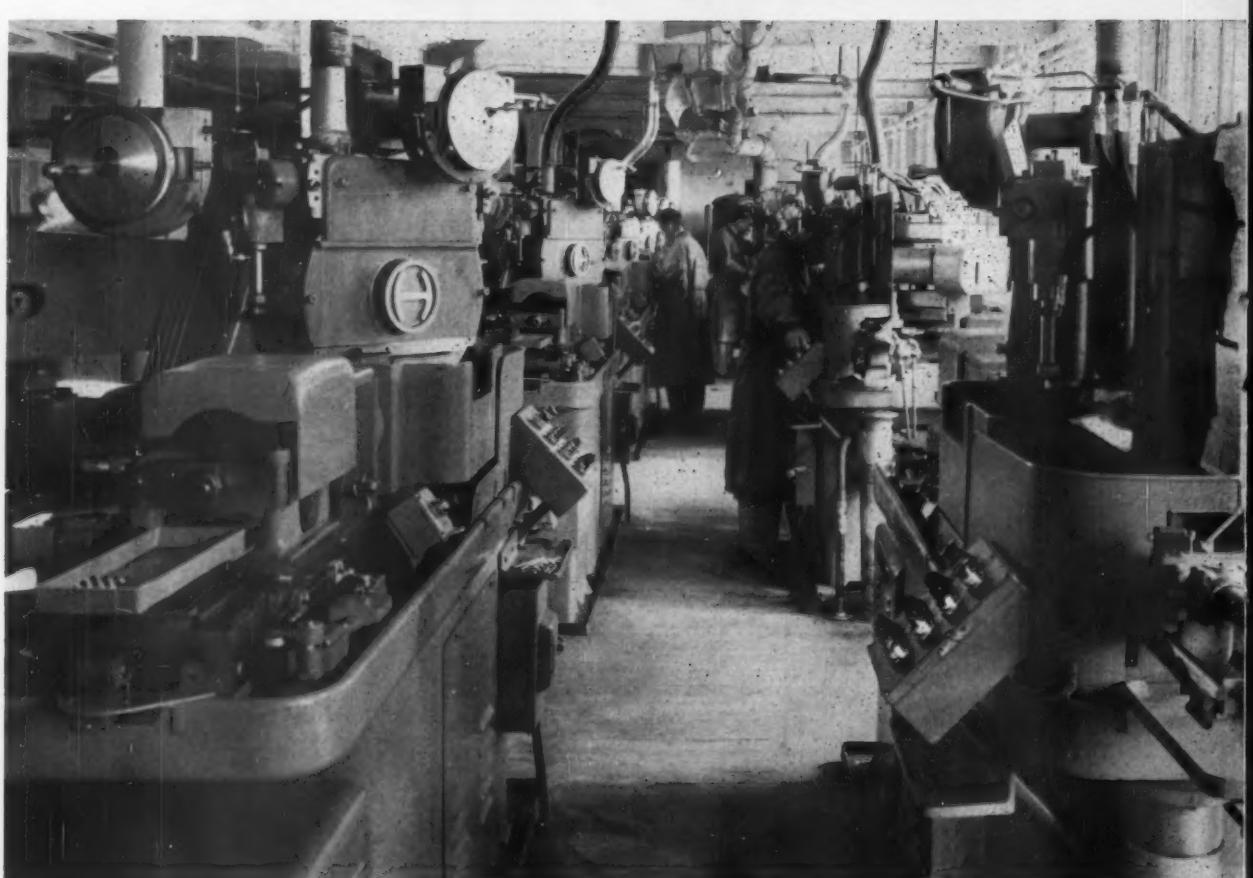
INCREASED STRENGTH WITHOUT INCREASED WEIGHT. Scientific diagonal-rib design gives over 30% added strength—greater rigidity and long-term accuracy.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

Another

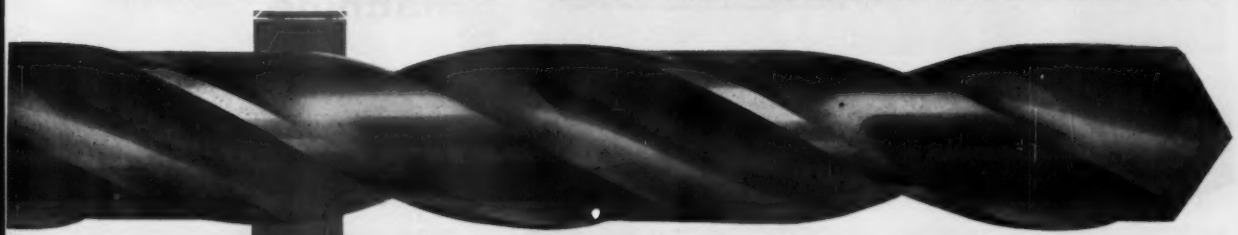
NEW FLUTE GRINDERS ARE

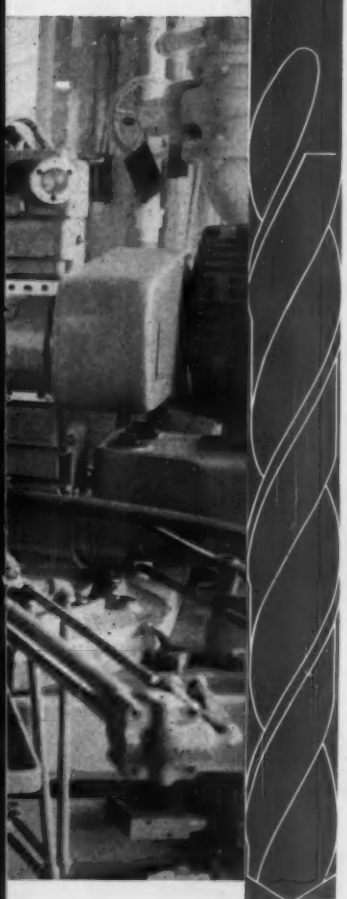


Still another Reason why

Morse First

THE FIRST OF THEIR KIND...





Now grinding from the solid up to 1/2 inch

And, here's what it means to you:

★ Smoother finish . . . better than polished flutes!

★ Consistently held tolerances . . . never attained by milling!

★ Better points . . . because of uniform flute depth!

★ Longer tool life . . . lower cost per hole!

This is why the new Morse flute ground drills are setting a new standard for quality . . . and, the only man who can show you is your Morse-Franchised Distributor.

MORSE TWIST DRILL & MACHINE COMPANY
New Bedford, Massachusetts
Subsidiary of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

MORSE *means* "THE MOST" *in Cutting Tools*

at the rate of **one every 3 seconds,**

the three surfaces of this

Transmission Governor Counterweight are broached

on the LAPOINTE **continuous-BROACHING machine**

. . . the machine that doesn't stop!

The part was new, never been made before. On figuring out the production economics, one of America's famous automotive plants came to the conclusion that it might be a good application for broaching.

So what did they do? Like you'd expect, they came to Broaching Headquarters . . . they came to Lapointe. Lapointe engineers set up the job for *continuous-broaching,* on the amazingly efficient LAPOINTE 20/66 CONTINUOUS-BROACHING Machine, and now these parts are literally rolling off the delivery end at *1400 per hour* when the machine is fully loaded with 18 fixtures.

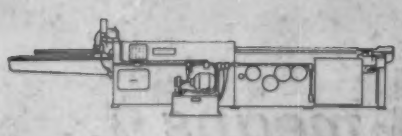
Lapointe handled the complete broaching problem — designed and built the machine, the fixtures, and the broaches. What a relief — to know that everything to do with broaching can be solved in one place, without divided responsibility! A Lapointe Field Engineer may be able to show *you* how to *eliminate production headaches* and *reduce production costs* by converting to Lapointe-Broaching. Why not investigate?

THE LAPOINTE MACHINE TOOL COMPANY

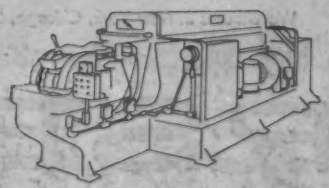
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

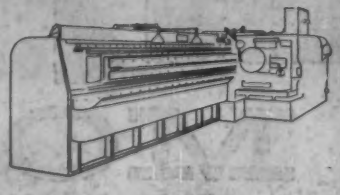
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



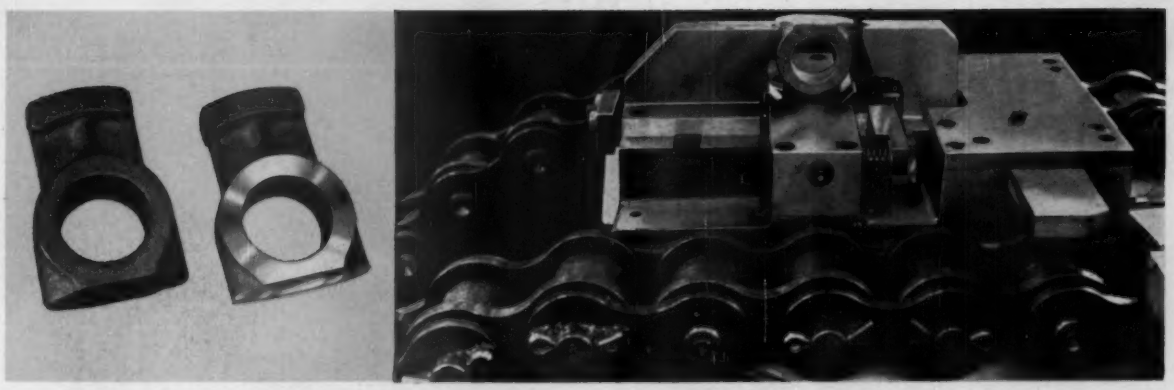
60" STROKE HORIZONTAL, ELECTRIC

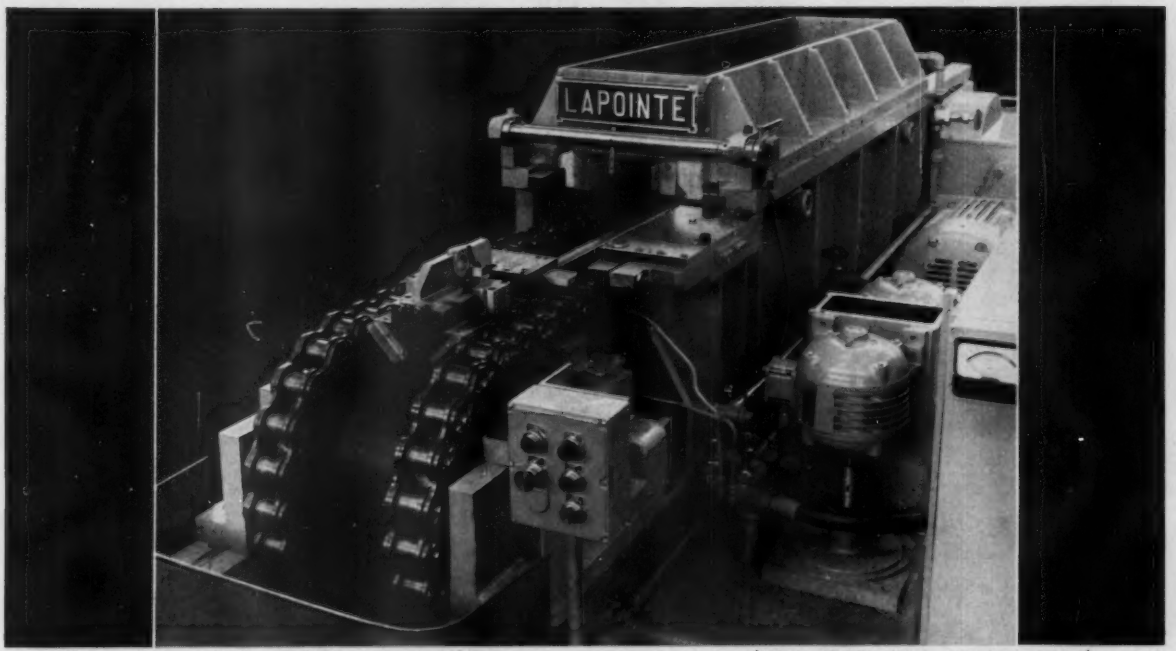


CH CONTINUOUS BROACHING, ELECTRIC

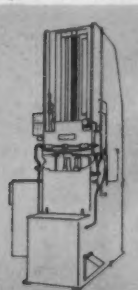


SRHE SINGLE RAM HORIZONTAL, ELECTRIC

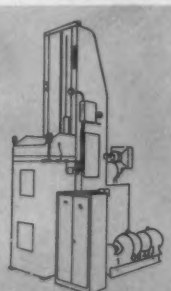




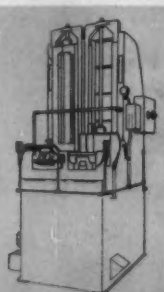
Two sides, and the end face of the transmission governor counterweight are broached on this Lapointe Continuous-Broaching Machine with electro-mechanical drive, designed for mass-production broaching of contour and flat surfaces to precision tolerances. This machine is available in four standard sizes (10 to 40 HP, 42- to 120-inch stroke) as well as in various combinations of horsepower and stroke. Fixtures are automatic-clamping, self-ejecting. Equipped with heavy-duty drive chain.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

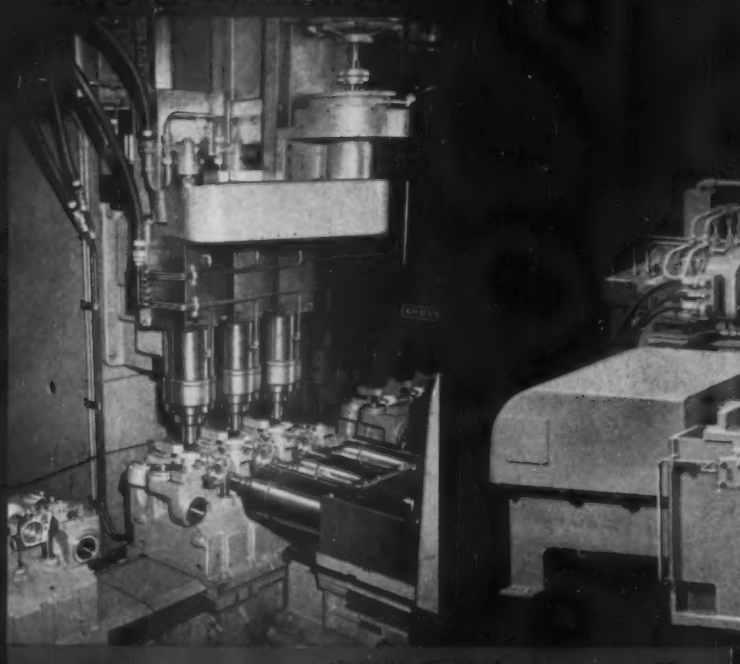
LAPOINTE

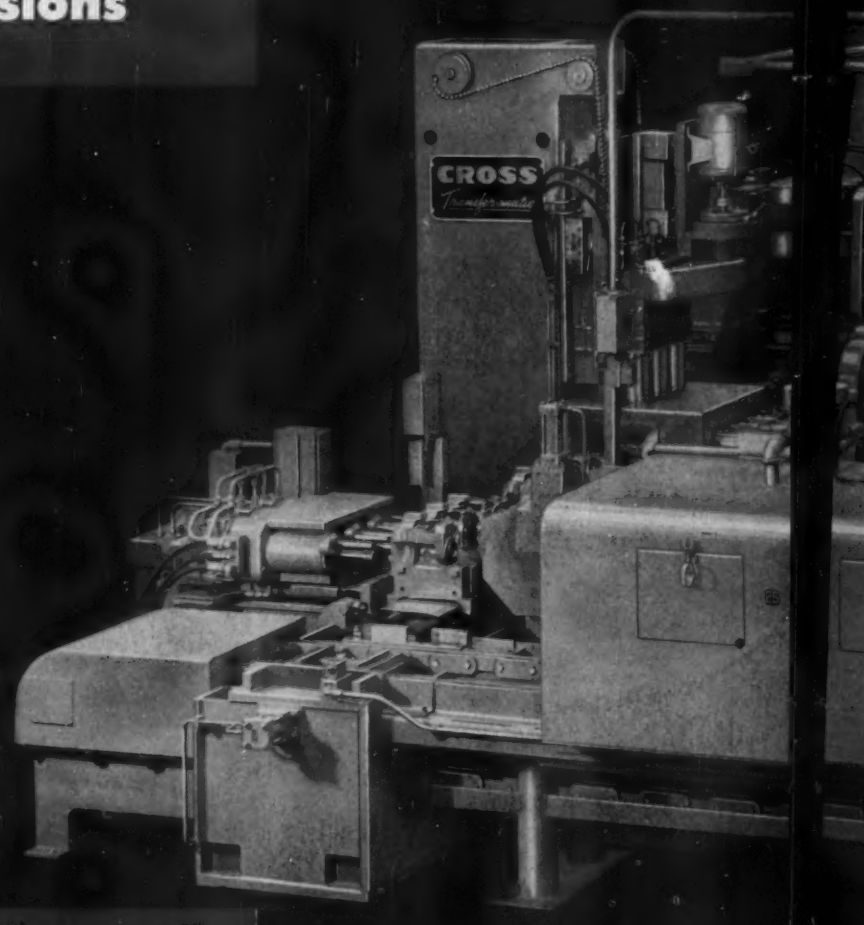
known to be the best in

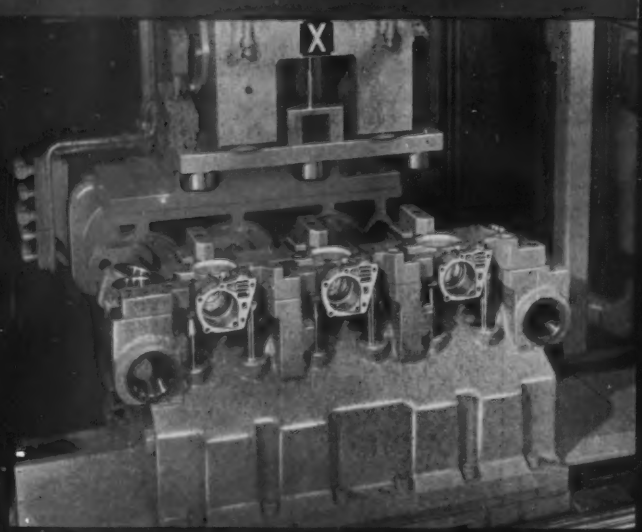
BROACHING

Completely Machines Servo Valve Bodies for Automatic Transmissions

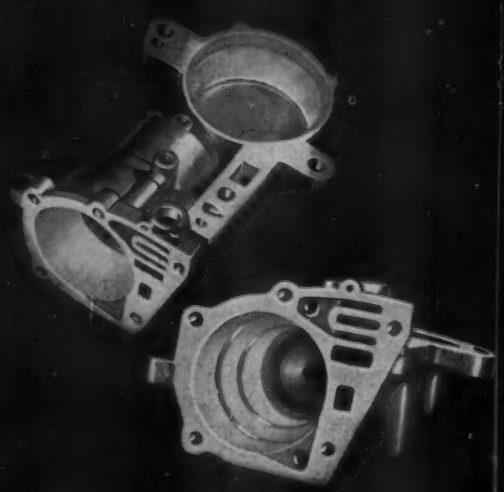
The final precision boring station.





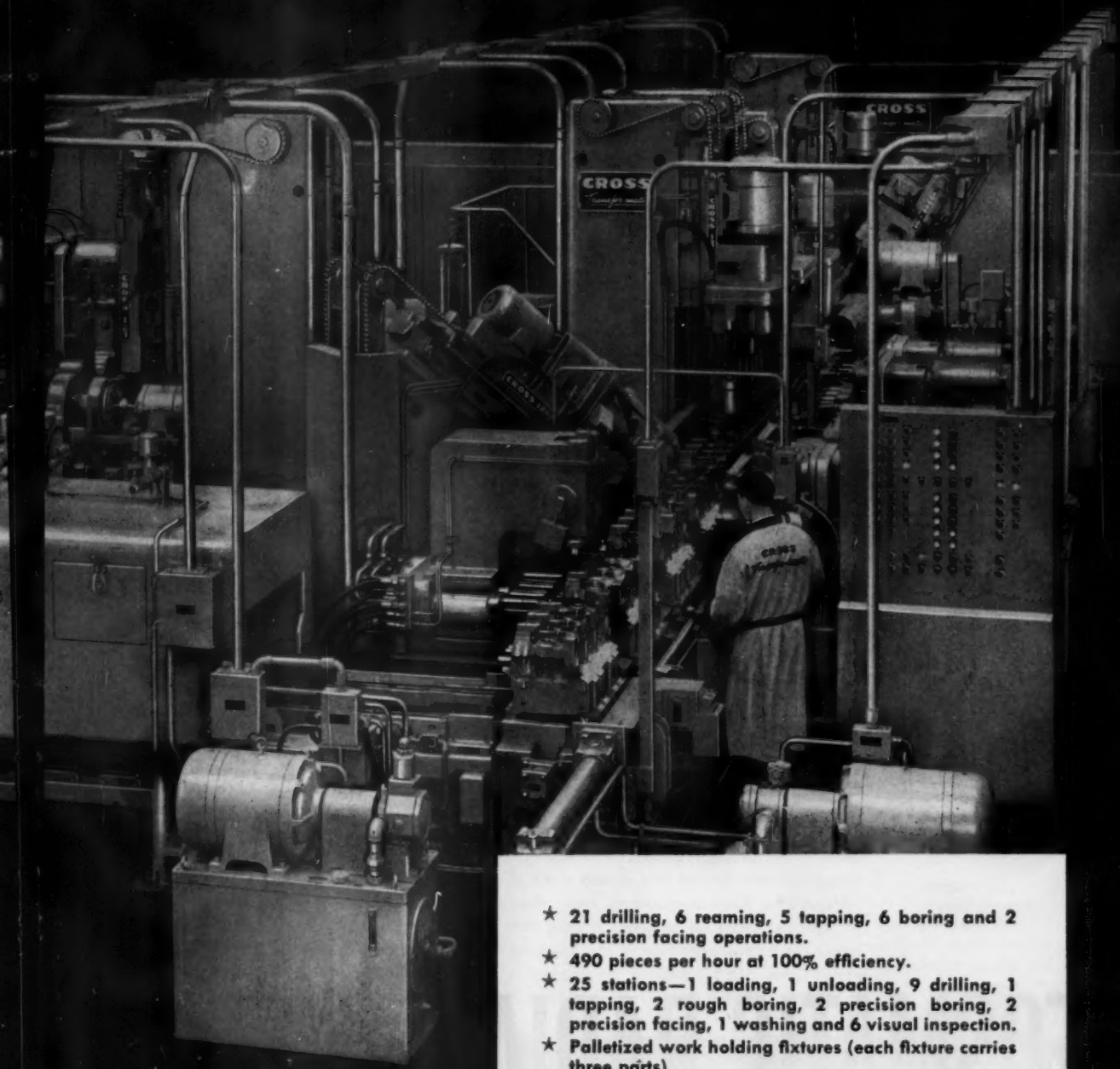


The loading station. Part locations are checked automatically by Unit X to assure proper clamping.



THE

Another Transfer-matic by Cross



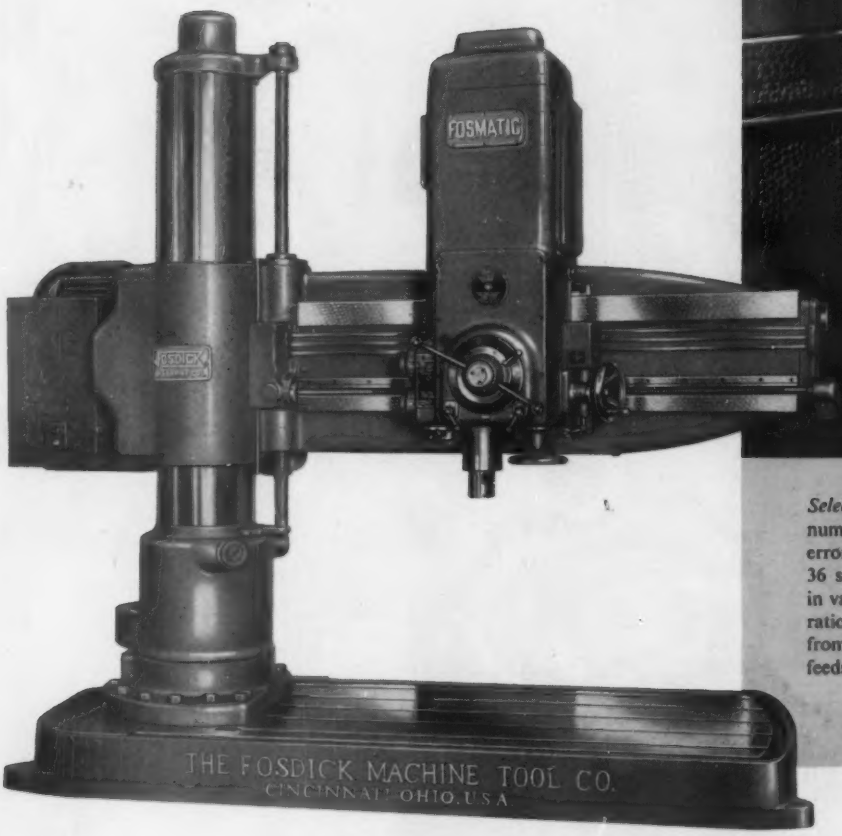
- ★ 21 drilling, 6 reaming, 5 tapping, 6 boring and 2 precision facing operations.
- ★ 490 pieces per hour at 100% efficiency.
- ★ 25 stations—1 loading, 1 unloading, 9 drilling, 1 tapping, 2 rough boring, 2 precision boring, 2 precision facing, 1 washing and 6 visual inspection.
- ★ Palletized work holding fixtures (each fixture carries three parts).
- ★ Unloading unit for removing parts from fixtures and placing them on conveyor.
- ★ Complete interchangeability of all standard and special parts for easy maintenance.
- ★ "Building Block" construction to provide flexibility for design changes.
- ★ Other features: automatic washing unit for fixtures; construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and boring; individual lead screw feed for tapping.

Established 1898

THE CROSS CO.

First in Automation

DETROIT 7, MICHIGAN



DIALS

Select feeds and speeds with easy-to-read numerical dials. Minimum possibility of error. To save time, select while drilling. 36 spindle speeds, maximum 3000 rpm, in variety of ranges, each with 127.5 to 1 ratio. 18 feeds, including 6 tap leads, from .003″ to .125″. Electronic milling feeds are also offered—from ¾ to 15 ipm.

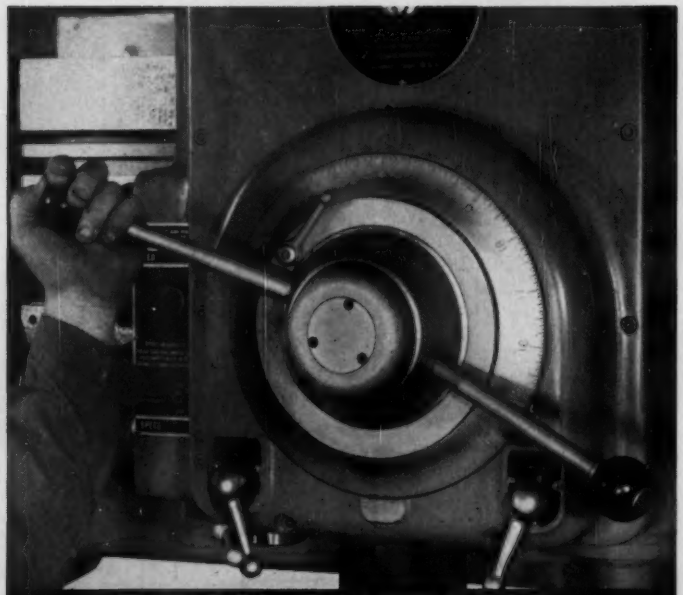
FOSMATIC RADIAL

SIMPLE CONTROLS

FAST, EASY PRECISION DRILLING

LEVER

Shift, start, stop and reverse with single lever. Shifting to new feeds and speeds is accomplished by raising lever slightly in its neutral position. For faster tapping, reverse spindle speed is up to 40% faster than forward speed.



PUSH BUTTONS

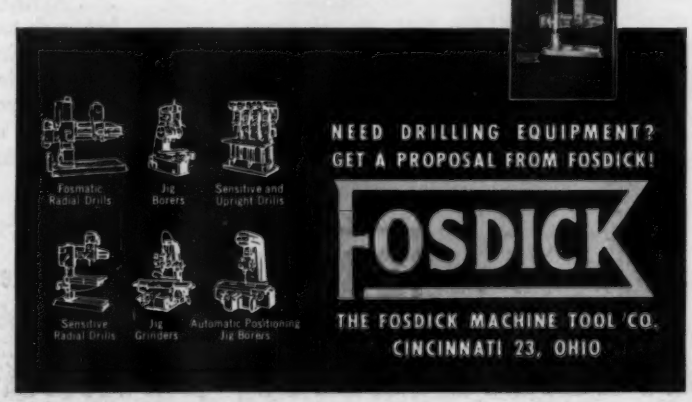
Engage feed by pressing button on either quick-return handle. Feed is disengaged by depth control or by pressing either button again. Feed dial is graduated to full spindle travel, to eliminate resetting for deep holes. Powerful magnetic clutch which engages feed will never need adjusting. Head and column can be clamped automatically when feed is engaged, if desired. They are unclamped by independent levers.

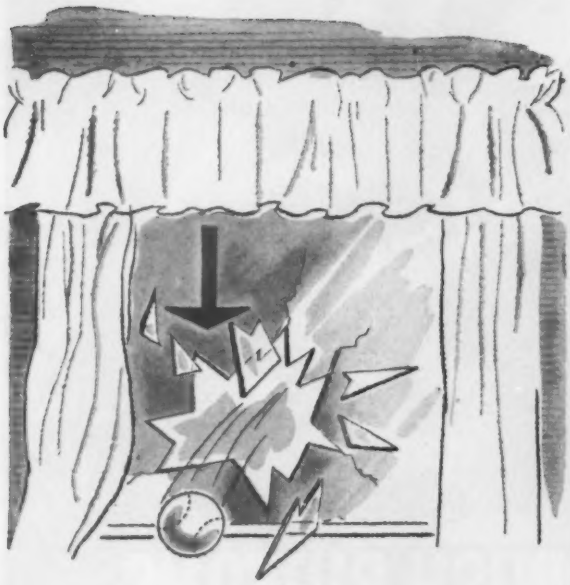
Fast, rigid, precise, easy to run—that's what today's machine shop demands in a radial. And that's what makes the Fosmatic outstanding among radial drills. The simple controls shown here save valuable seconds of operator's time, with each hole drilled. Other convenient controls at the head—single lever to raise and lower arm (hydraulic clamp interlocked) and traverse head; hydraulic column clamp; hand feed and traverse to head; tool ejector eliminates need for tang driver.

The new boring-type spindle is of heavy section with bearings placed far apart for extreme rigidity; it can be used for boring, milling and the heaviest drilling. A new and unique counterbalance produces equal tension on the spindle whether it is extended or close to the head. Case-hardened gears are ground on the finest equipment available. They run on ground splined shafts which are mounted in ball bearings. Lubrication is automatic.

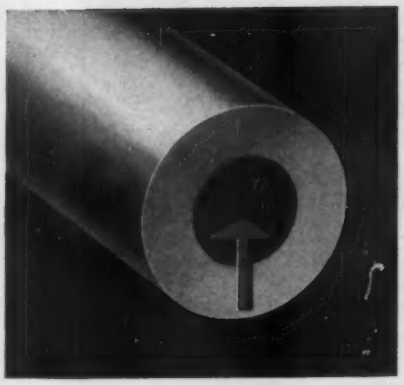
Our new arm is the strongest in the business. It has a double box section with very heavy walls; ways have been widened considerably. The head is mounted on roller bearings on hardened and ground ways with an additional roller support in back of the arm. Safety nut is hydraulic. Column is superfinished.

Standard sizes available with 4′ to 8′ arms, 13″ to 19″ columns. Write for Catalog RD-A.





a hole here means work...



a hole here saves work

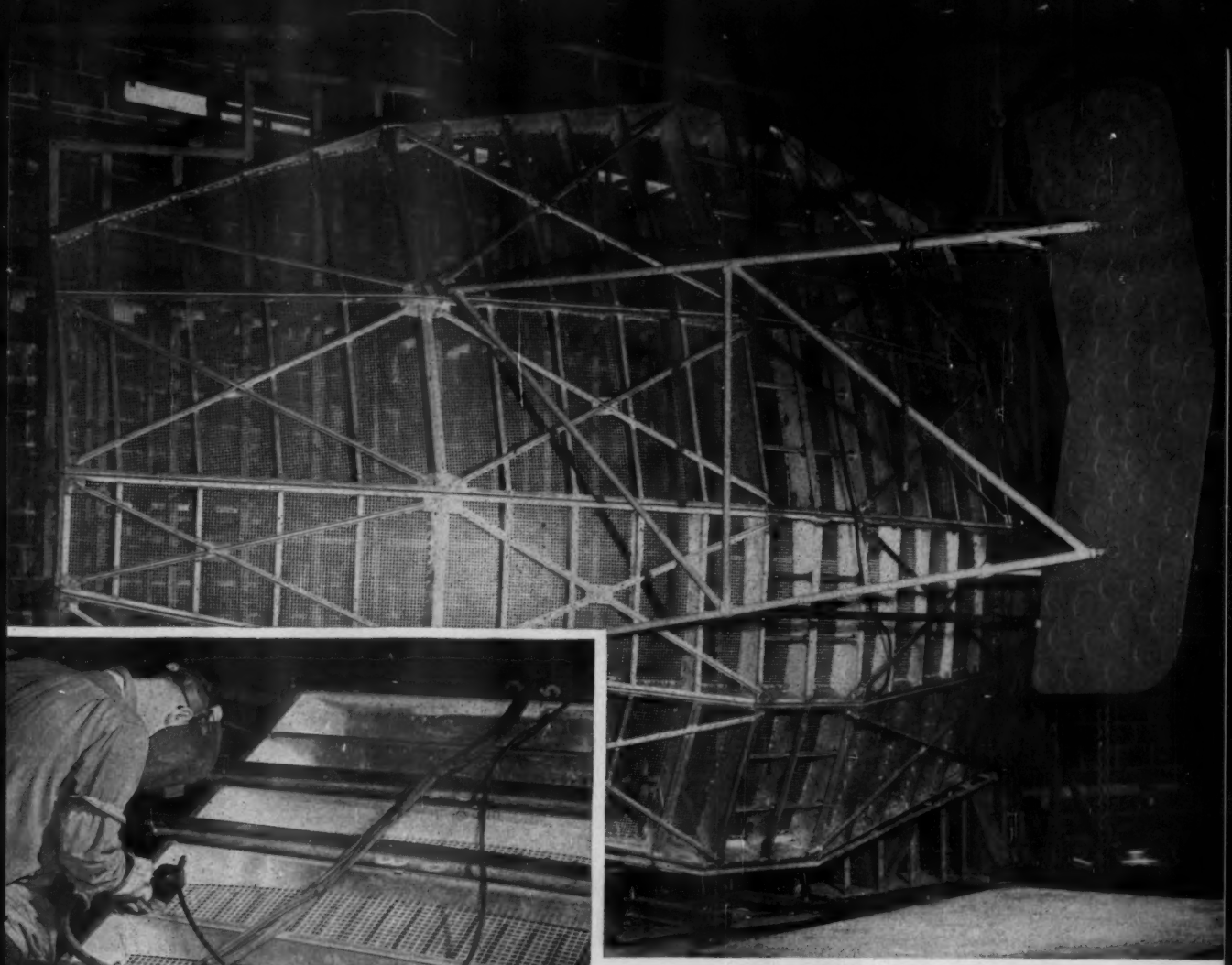
Crucible Hollow Tool Steel Bars take much of the work out of making ring-shaped steel parts, or tools with a center hole. The hole's already there. You save expensive drilling, boring, cutting-off and rough-facing operations . . . you reduce machine time and scrap losses.

You can now get Crucible Hollow Tool Steel Bars in any of the famous Crucible tool steel grades, in virtually any I.D. and O.D. combination. And you can get *immediate delivery* from stock of the five most useful grades — KETOS oil-hardening . . . SANDERSON water-hardening . . . AIRDI 150 high-carbon, high-chromium . . . AIRKOOL air-hardening . . . NU DIE V hot-work tool steels.

Your Crucible representative can quickly show you how Crucible Hollow Tool Steel Bars will save you work and money. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America



Completed aluminum radar antenna (above) stands more than 20 feet high at the Garden City, Long Island, plant of General Bronze Corporation. At left, a welding operator uses General Electric Fillerarc* equipment to weld $\frac{3}{32}$" diameter aluminum screen to an antenna section frame—a tough welding job because all welds must be sound enough to support the weight of the antenna under constant buffeting from the wind.

Fillerarc* welding of radar antennae is 10 times faster, costs 25% less

Fabricating giant, aluminum radar antennae can be a costly and time-consuming operation. But General Bronze Corporation of Garden City, N. Y., has found that compared with the tungsten-arc method formerly used, it can speed such welding 10 times while cutting costs 25 per cent with General Electric Fillerarc gas-shielded, consumable-electrode equipment.

Requirements for welding the antennae are demanding. Each antenna is composed of sections of varied size and shape, which must be assembled to form the completed unit. Materials used range from $\frac{1}{8}$" aluminum frame to $\frac{1}{16}$" cross channels and $\frac{3}{32}$" diameter aluminum screen.

*Registered trademark of the General Electric Co.

Preliminary tests using semi-automatic Fillerarc equipment resulted in strong, smooth welds, and the trouble and expense of cleaning up flux was eliminated. So, General Bronze now uses Fillerarc welding equipment on all its antenna work and is looking for other jobs Fillerarc can do faster and at less cost.

And, Fillerarc is versatile. It can weld mild and stainless steel, bronze, nickel, and magnesium. For more information on how Fillerarc can save you time and money, call your nearby General Electric welding distributor (see the yellow pages of your phone book), or write for bulletins GEC-989 and GEC-1334 to Section 713-6, General Electric Co., Schenectady, N. Y.

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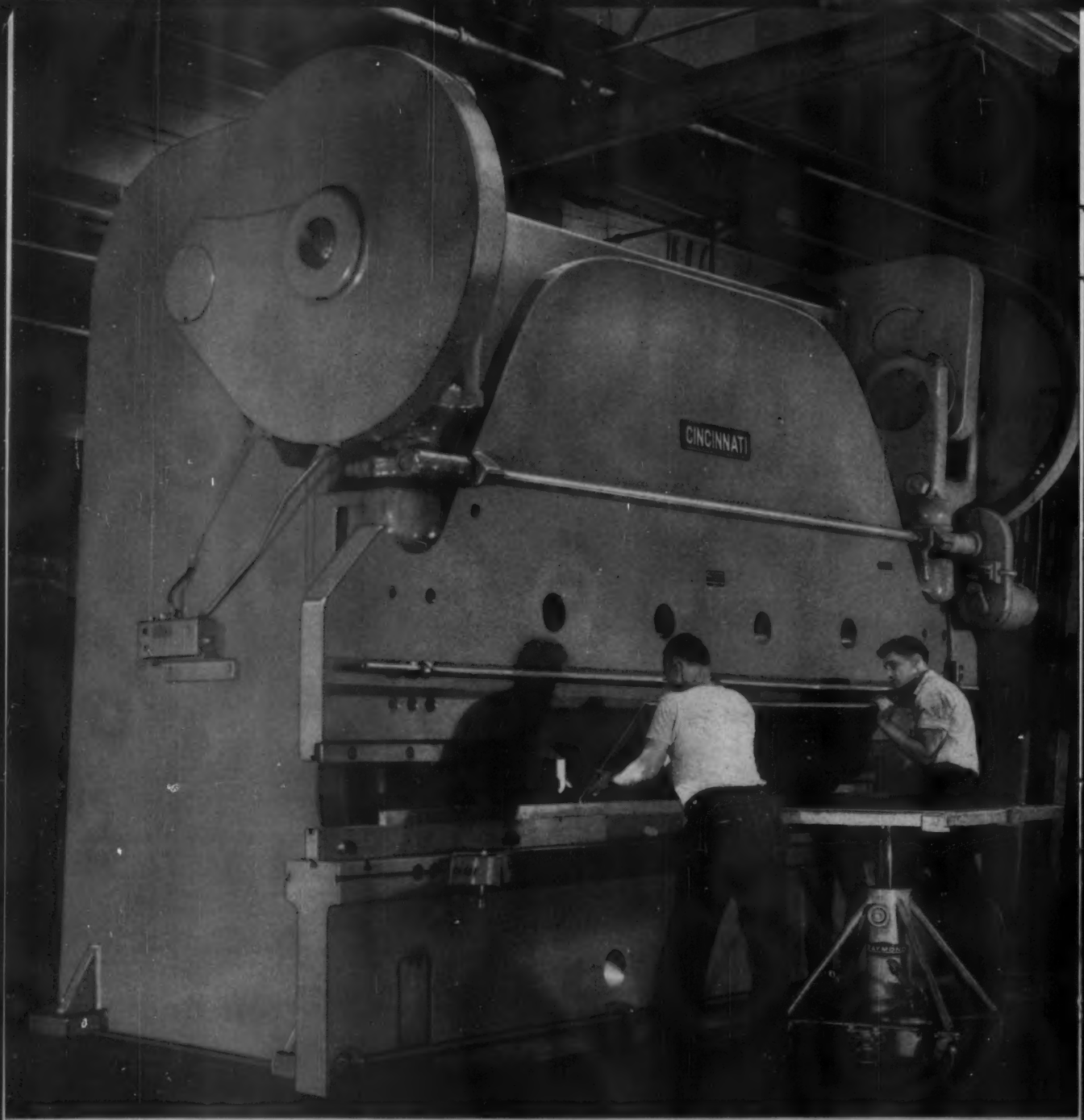


This 13 Series x 12′ Cincinnati Press Brake has a capacity of 250 tons and is used for many types of forming and punching work at the Falstrom Plant.

This 2512 Series Cincinnati Shear has a capacity of ⅜″ x 12′ long mild steel plate, and is used to shear a variety of metals to micrometer accuracy.

● Photos courtesy Falstrom Company, Passaic, N. J.

CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

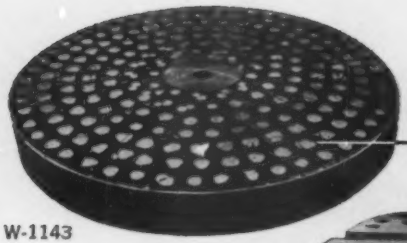
Cincinnati Shears and Press Brakes produce a wide variety of precision custom metal work

at FALSTROM COMPANY, Passaic, N. J.

Three Cincinnati Shears and five Cincinnati Press Brakes are profitable producers in this finely equipped plant. A broad variety of precision work in many different metals is done on these versatile machines, yet changes from job to job are made rapidly with minimum loss of time. Due to the accuracy of their Cincinnati Shears and Press Brakes, Falstrom Company has been able to minimize the use of welded construction in their special fabricated products.

•

Consult our Application Engineering Department about ***your*** production problems, and write Department A for Catalog S-7R on Cincinnati Shears and Catalog B-4R on Cincinnati Press Brakes.

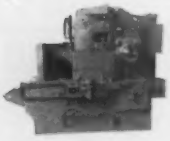


W-1143

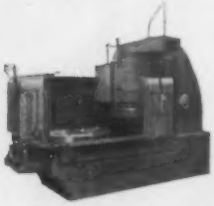
tiny or **tremendous...**

W-1145

For best results... ***PUT IT ON A BLANCHARD!***



Blanchard No. 18



Blanchard No. 42-84

There's a Blanchard for every surface grinding job, in a broad range of sizes. For example, the Blanchard No. 18 grinds non-magnetic transistor elements (upper left) .006" thick, to a tolerance of .0005" with good finish. This job, which involved .006" to .008" stock removal per side, was held on special fixture plates.

At the other end of the scale, a huge Blanchard No. 42-84 Grinder grinds a turbine housing (upper right) which measures 83" across the corners, and is 28" high. This housing, ground after rough machining, required .020" stock removal. Both this piece and its mating part were ground to a steam-tight joint.

Whatever *you're* grinding—be it tiny watch parts, giant steel plates, or anything in between—there's a Blanchard designed to do the job speedily and accurately.

Ask for details on the 15 standard Blanchard models.

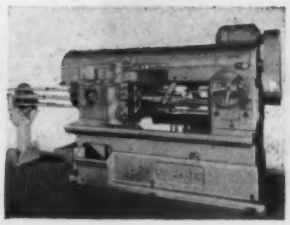
PUT IT ON THE BLANCHARD

Send for free copies of "Work done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

If you haven't read this important booklet, your production line may be operating at less than peak efficiency. Your operations may be beating competition with HSS today, but you will likely need carbide tooling to be the leader tomorrow.

Write for your free copy of this important booklet today!



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Acme-Gridley

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Built to meet the demand for a smaller faster multiple, the new 7/16" RA-6 machine has taken its place in the Acme-Gridley line—chosen by production men who daily prove the advantages of National Acme's "complete line" experience to furnish the right machines for the job.

. . . THE NEW 7/16" SIX

gives you lowest cost per piece

HIGH PRODUCTION ACCURACY—sustained at highest speeds and feeds through proper weight distribution and support of toolholders without overhang.

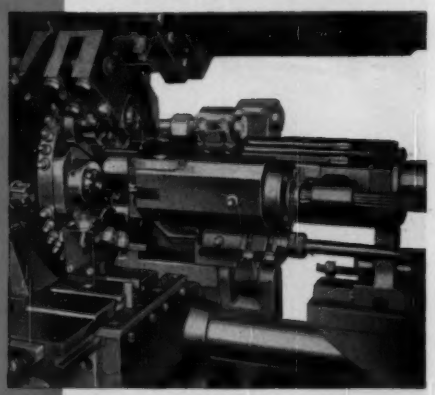
WIDE TOOLING VERSATILITY—through independently operated cross slides, spindle stopping (optional) and a variety of standard and special attachments.

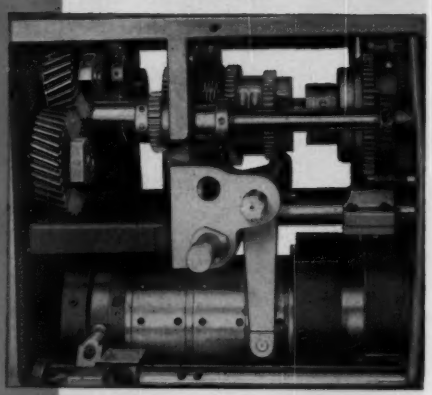
LONG OPERATING DEPENDABILITY—with extra reserve power and strength for top performance with *all* tools.

★ ★ ★

Let our representative show you how Acme-Gridleys can work for you; meanwhile, *write for your copy of* MRA-56 *for specifications of the new 7/16" Six.*

Unusually large tooling zone permits ready access for installation and adjustment of tools and attachments. All slides are wide and heavy, providing maximum support without overhang.





Gear box section accommodates drive control for all accelerated end-working attachments, spindle speeds and feeds . . . easily accessible through large openings on either side.

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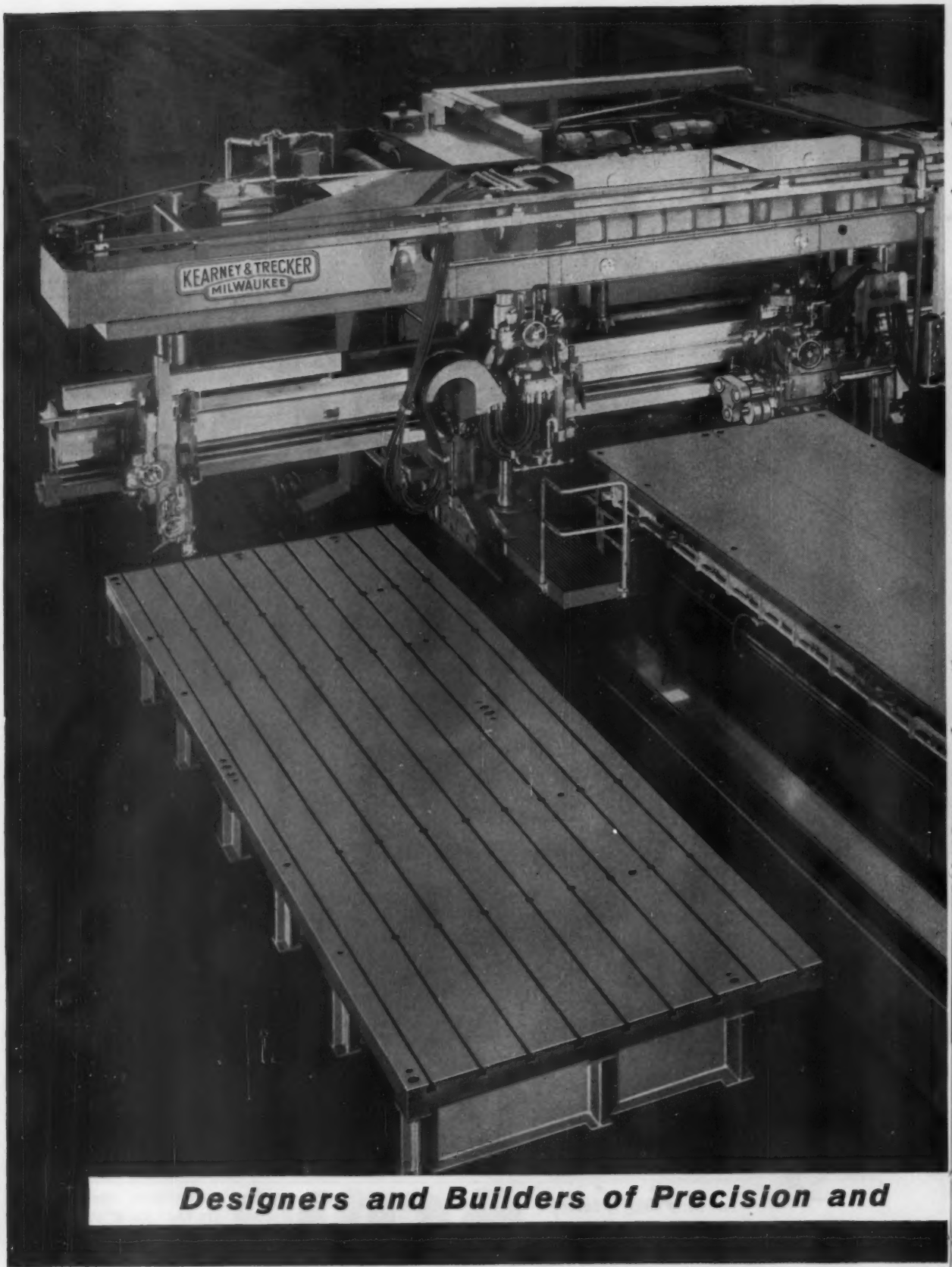

Designers and Builders of Precision and

Picture your workpiece on this 175-ton

KEARNEY & TRECKER MILWAUKEE

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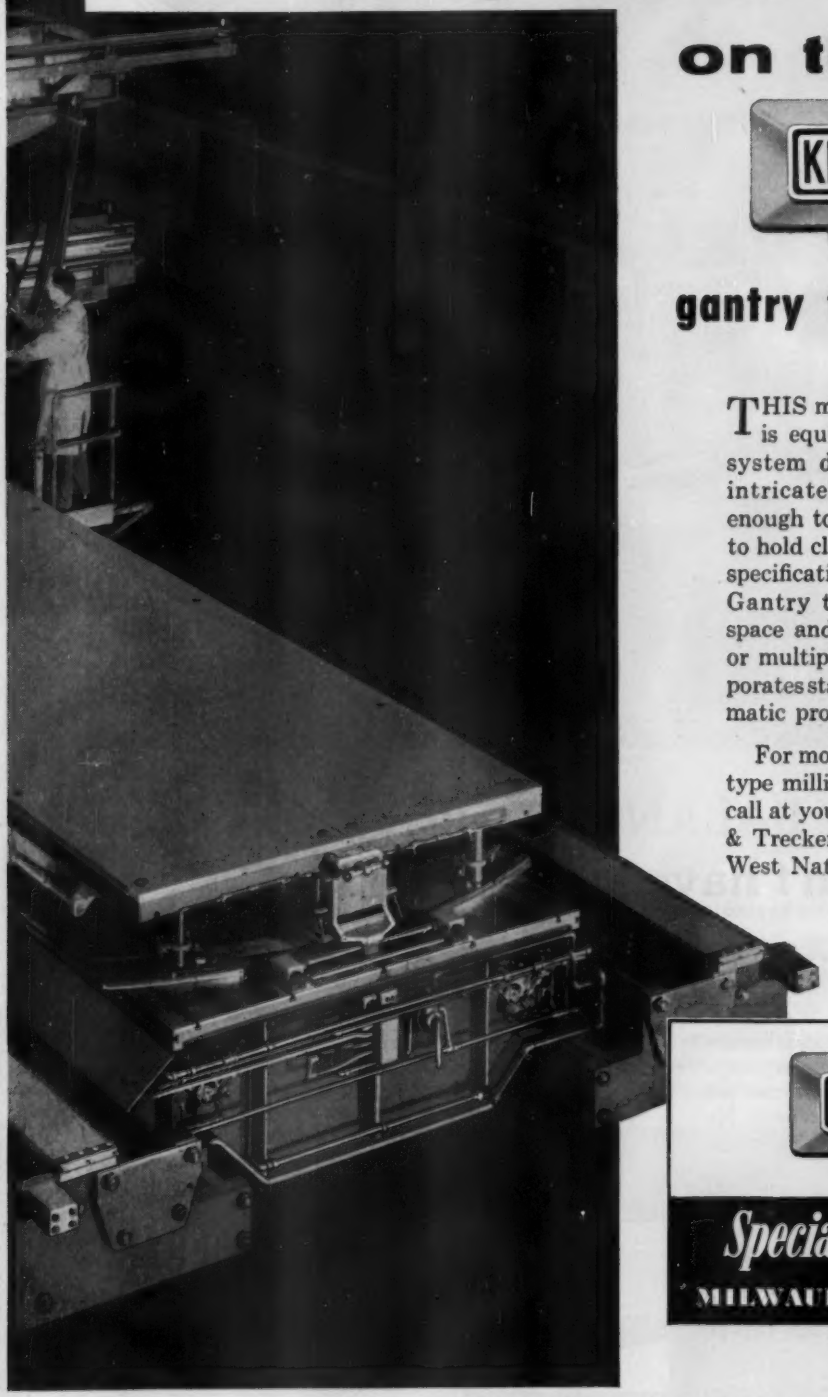

THIS massive giant, 42 ft. long, 35 ft. wide, is equipped with electronic tracer control system designed for production milling of intricately contoured workpieces. Rugged enough to mill all metals . . . sensitive enough to hold close tolerances . . . it meets all A. I. A. specifications and has extendable bed design. Gantry type machine takes much less floor space and permits handling larger workpieces or multiple workpiece setups. Machine incorporates standard design components with automatic programming control systems available.

For more specific information on this gantry type milling machine, have our representative call at your convenience . . . or write to Kearney & Trecker, Special Machinery Division, 6786 West National Ave., Milwaukee 14, Wis.

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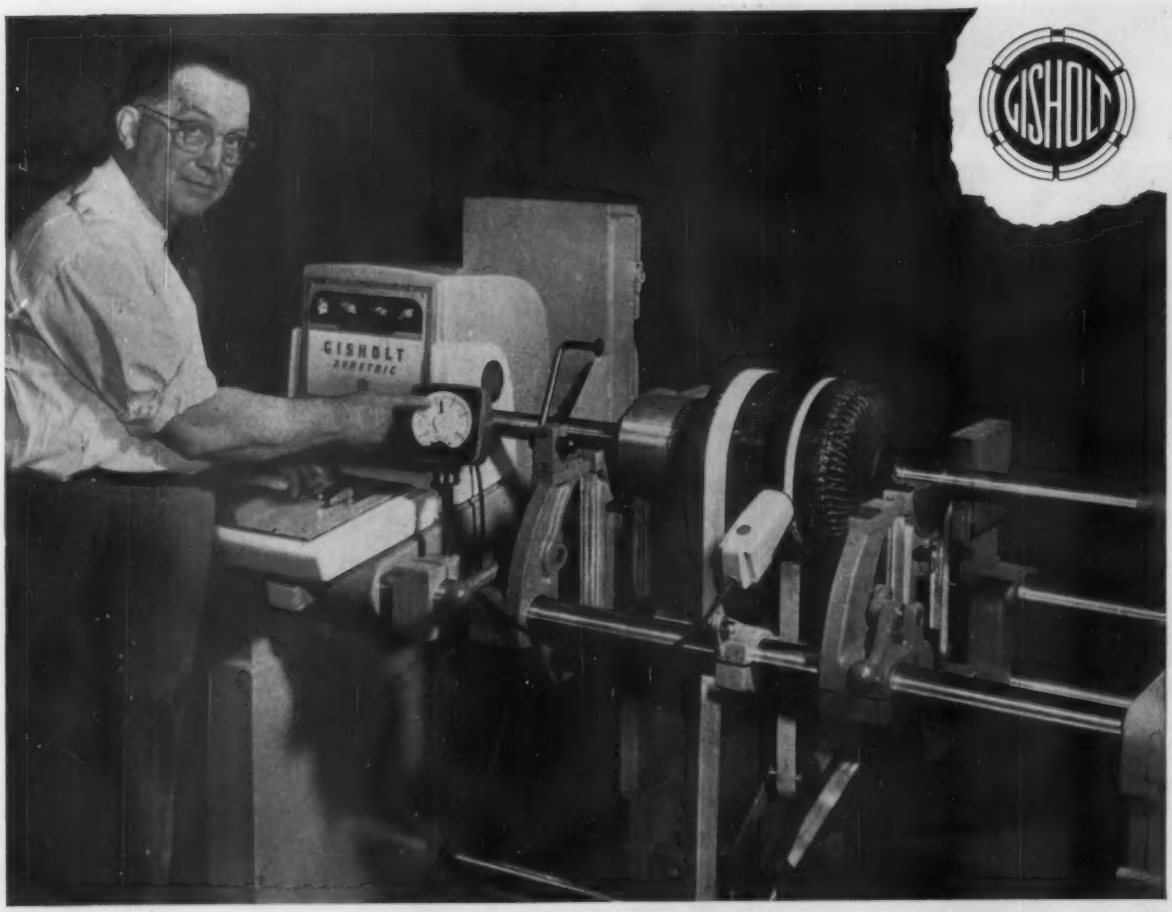
Production Machine Tools Since 1898



When a GISHOLT BALANCER tells you the story —you don't have to translate it!

Note that dial reading! It does more than you may suspect.

Unlike other balancing machines, it does not merely indicate amount of unbalance in arbitrary units and leave it to the operator to interpret in terms of correction. Gisholt Balancers can tell the story *directly* in terms of correction units. No translation needed. No computation. No charts or graphs.

Because of their infinitely variable sensitivity, Gisholt Balancers are easily adjusted for the job at hand. Correction units such as ⅛" lengths of wire solder, 1/64" depths for a certain size of drill, washers of a specific weight, etc., can be used. Readings, in terms of these units, are shown directly on the amount meter.

Think what that means in time saving alone! Yet this is only one of many ways Gisholt enables you to set—and maintain—higher standards for your balancing work.

If your product includes the use of rotating parts, by all means check Gisholt for the most recent information on balancing.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

DYNETRIC BALANCERS (GISHOLT)

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

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horizontal optical jig borer

with 5 optical microscopes

DESIGNED AND BUILT FOR:

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Optical settings for operations in all planes and compound angles . . . Equally suitable for tooling, short-run or production work . . .

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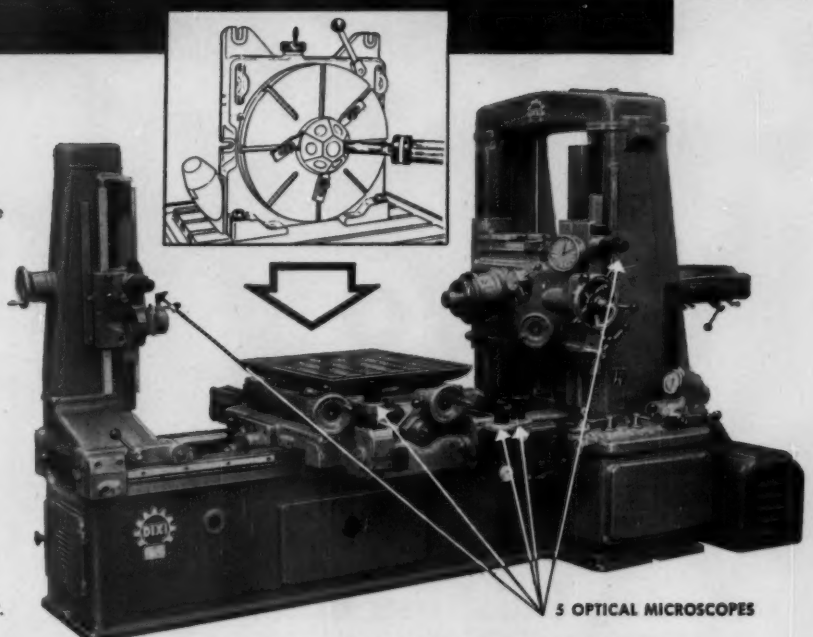
Overall accuracy of .0002"

A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32⅝". All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

DIXI 450 PRECISION OPTICAL CIRCULAR DIVIDING TABLE

Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.



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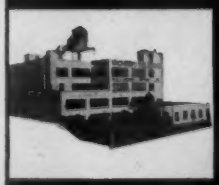

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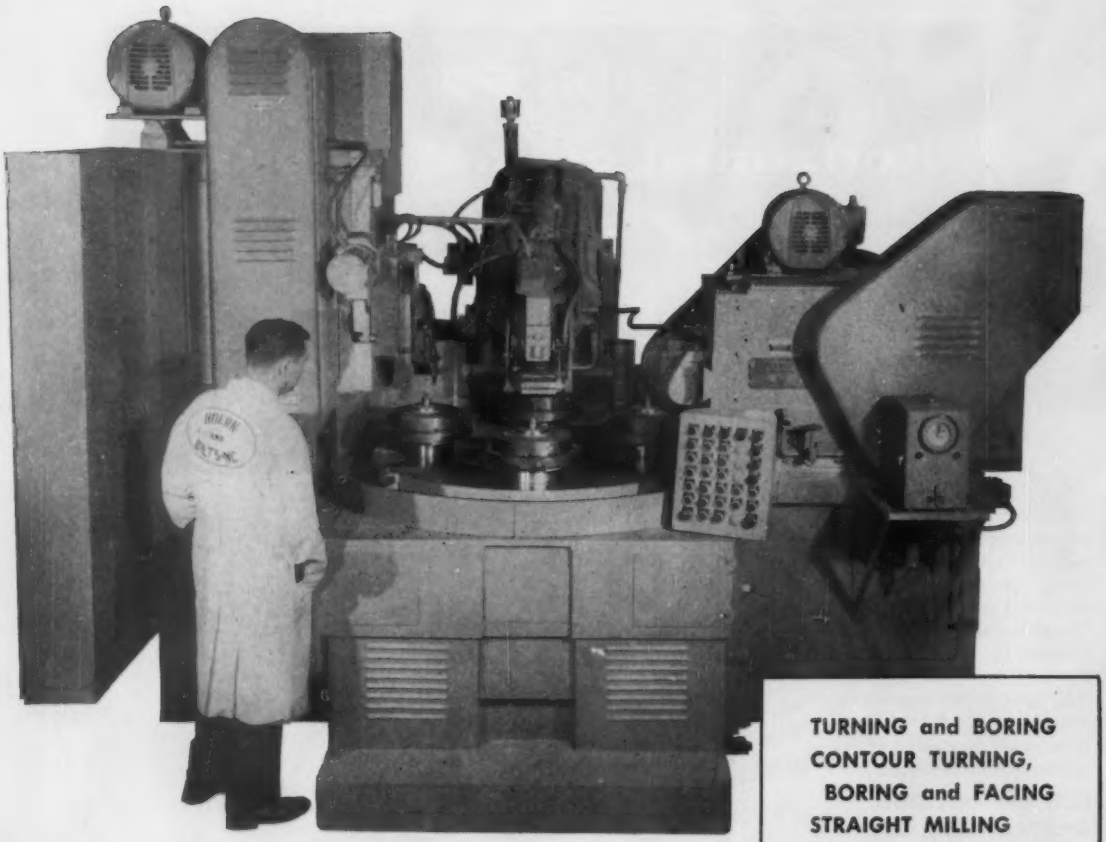

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You can combine these finishing operations on one Hoern & Dilts indexing finishing machine →

Indexing Table: Mounted on pre-loaded roller bearings. Index accurate to .0002". By providing adjacent spindles with proper chucking devices, *both ends* of a piece may be put through identical or closely related operations.

Heads: Individually cam-actuated heads, each designed for a specific type of operation which may be performed vertically or horizontally as required. Heads self-contained, with individual electrical, pneumatic and lubricating systems.

Speeds: One over-all speed may be used, or a different speed at each station. Spindles may be stopped and locked in any predetermined position at any station.

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This advanced approach to increased, more accurate production is accomplished by arranging a variety of self-contained heads around a central indexing table in which the spindles are mounted. Since all the operations are performed with a single chucking, all the proper relationships are maintained.

Hoern & Dilts engineers will welcome the opportunity to cooperate with you on any high production finishing operation.

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Old skills modern facilities give you premium Carbide Tool performance

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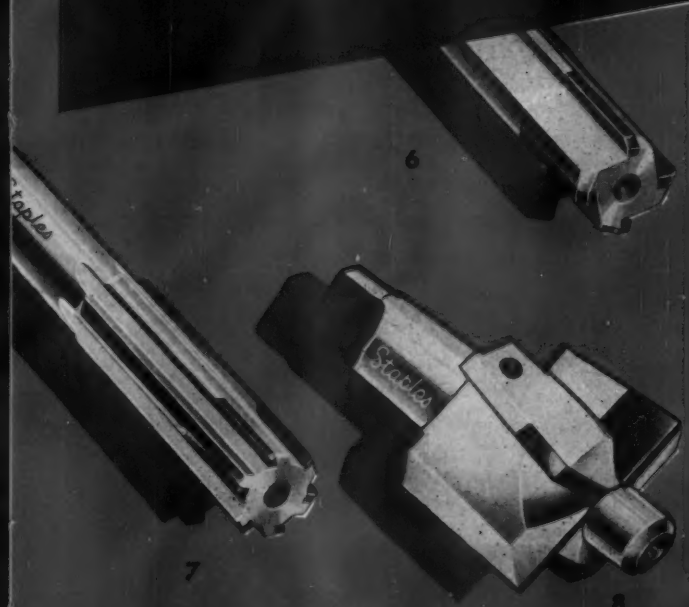

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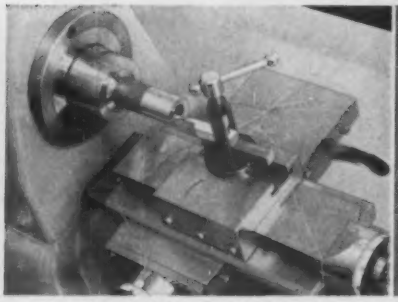
Correct Size - High Speed - Precision Results



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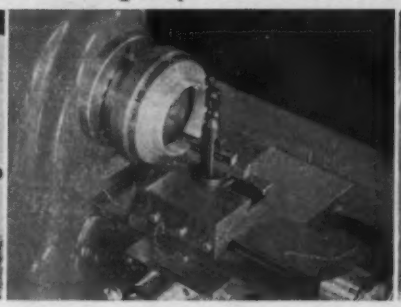

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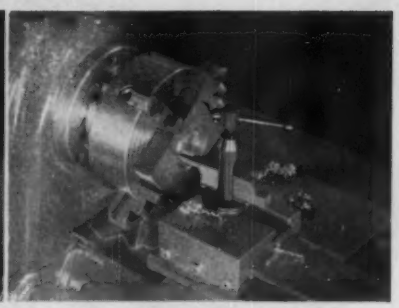

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17" Center Distance
Infinitely Variable Speed
230—3500 r.p.m.

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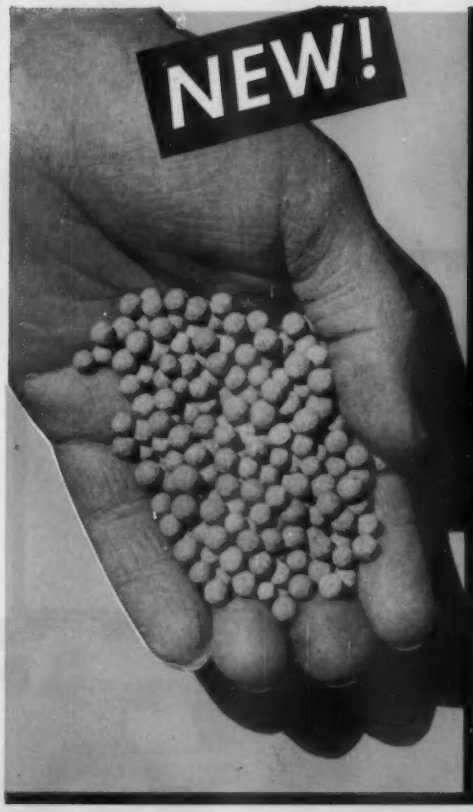

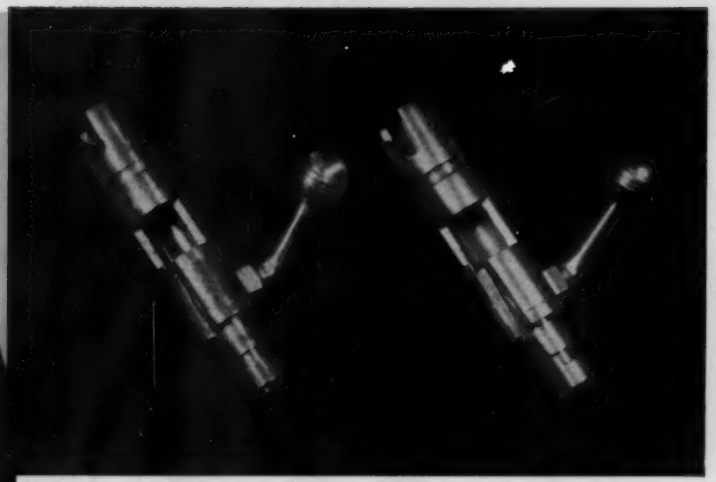

The new ALUNDUM Tumblex "S" abrasive rolls around and through intricate parts; brings high uniformity of radii and surfaces, with smooth finish, to the barrel-finishing of parts as intricate as this gun component. The "before and after" view shows you how the spheres improve external and *internal* areas.

Besides this 3/16" diameter size of Tumblex "S" you can order it in four other sizes, up to 1/4". This means top barrel-finishing performance for you, in many different applications. And these new spheres are exceptionally dense and long-lasting.

Another big advance in barrel-finishing

Norton Tumblex "S" abrasive spheres

From the pioneer of ALUNDUM bonded triangles — now, new bonded spheres to help you do a better job*

If you finish parts that have hard-to-contact recesses or intricate shapes, Tumblex "S" tumbling abrasive is the latest development.

Here are the reasons why tubing, coil springs, scissor handles, bearing retainers, pump bodies and many other parts benefit by the new shapes and sizes of Tumblex "S" — and its top-quality as a tumbling abrasive.

- *Tumblex "S" is made in spheres that easily get into areas where other abrasive shapes can't reach.*
- *Made of famous Norton ALUNDUM abrasive, it cuts fast — resulting in shorter time cycles and lower costs per piece finished.*

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#3—5/32"	#5—9/32"
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NORTON
ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS:
Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes

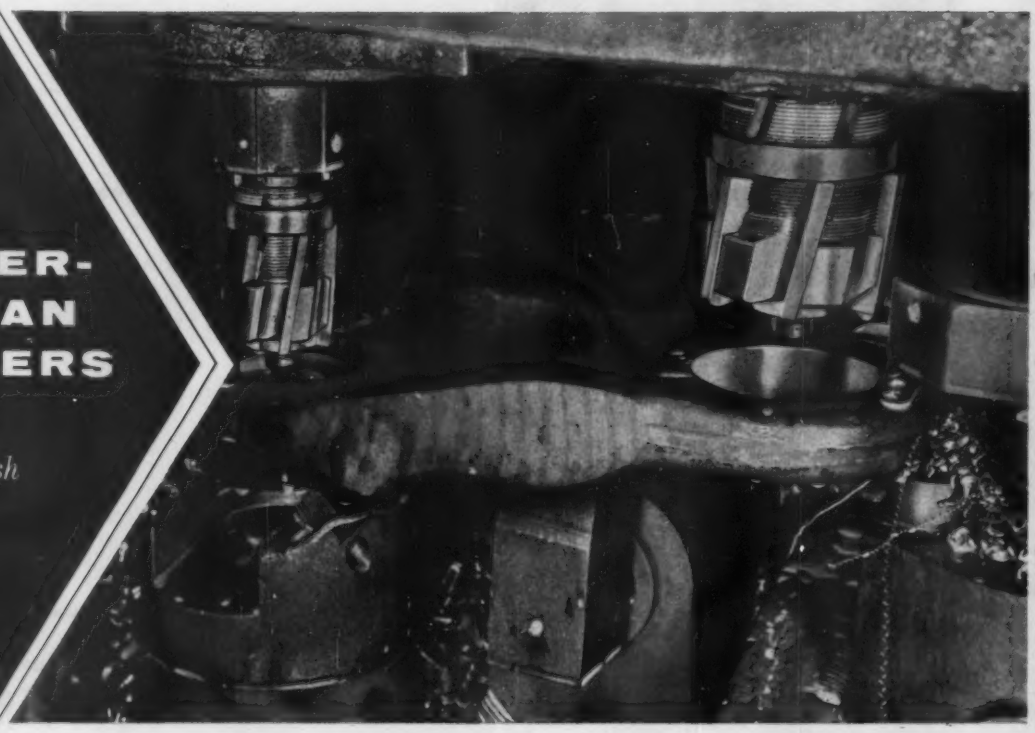
CATERPILLAR
proves...

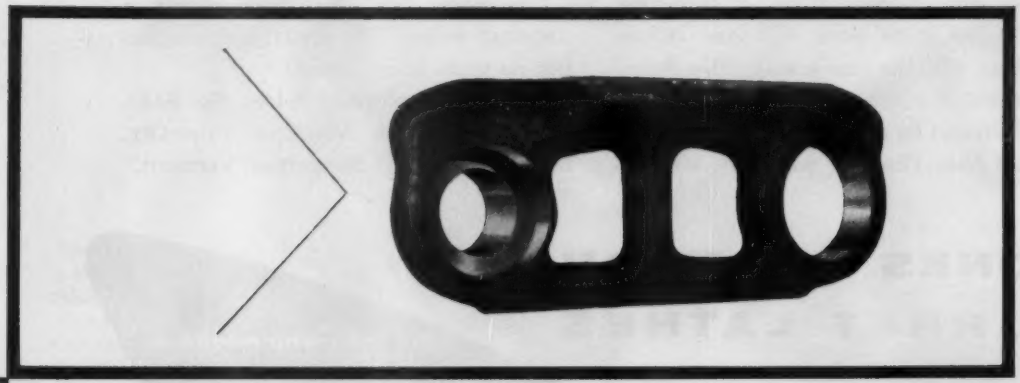
good reamer design helps hold size

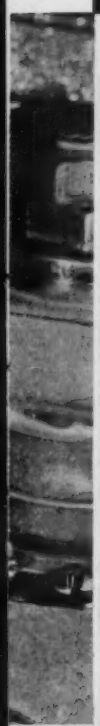
and

tool life in tough materials

BARBER-COLMAN REAMERS
provide
required finish
and
production







Caterpillar Tractor Co. finish reams 2 holes in these tough forged steel track links with the required surface finish and a production rate of 102 pieces per hour from each machine. Previous operations include core drill and rough ream the large hole, and core drill and counterbore the small hole. Four hundred pieces are obtained per sharpening in this tough, hard material. Finish reaming is used because it is the only means available which will produce the required finish and meet the high production requirements of this job.

these are the job facts:

Bore Size	2.605"	1.738"
Stock Reamed	.025"	.025"
Cutting Speed	75 rpm.	100 rpm.
Production	102 per hr.	102 per hr.
Feed	.011" per rev.	.013" per rev.

These Barber-Colman reamers were specially designed to suit the requirements of this part. The design of the reamer body provides maximum backing for the cutting edge and a large chip space in front of the blades to insure good chip flow.

The direction and angle of spiral are designed to provide the most efficient cutting action in this material. The reamer body is specially heat treated for toughness. These reamers are sharpened with a positive primary clearance. The nose form includes a chamfer, lead, and straight portion which are specifically designed for the job. Behind the nose, a back taper provides adequate clearance in the finished hole. These elements of the profile are accurately maintained by cam-controlled sharpening on the Barber-Colman Combination Sharpening Machine.

When you have hole finishing problems involving accuracy, finish, tool life and production requirements, call a Barber-Colman reaming expert and talk over with him the most economical way to get the results you want.

BARBER-COLMAN COMPANY

912 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

The ONLY Turret Lathe with a fully automatic thread-chasing cycle!

Here is full turret lathe versatility and a threading attachment with a fully automatic cycle — all in one machine. Now you can be sure of concentricity of threading with other lathe work, *all done in one chucking*, with the time saving of the Auto-Threader! Nowhere else in the world can this be found on a turret lathe.

This Auto-Threader will chase straight or taper threads — or a combination — internal or external, from the front of the machine.

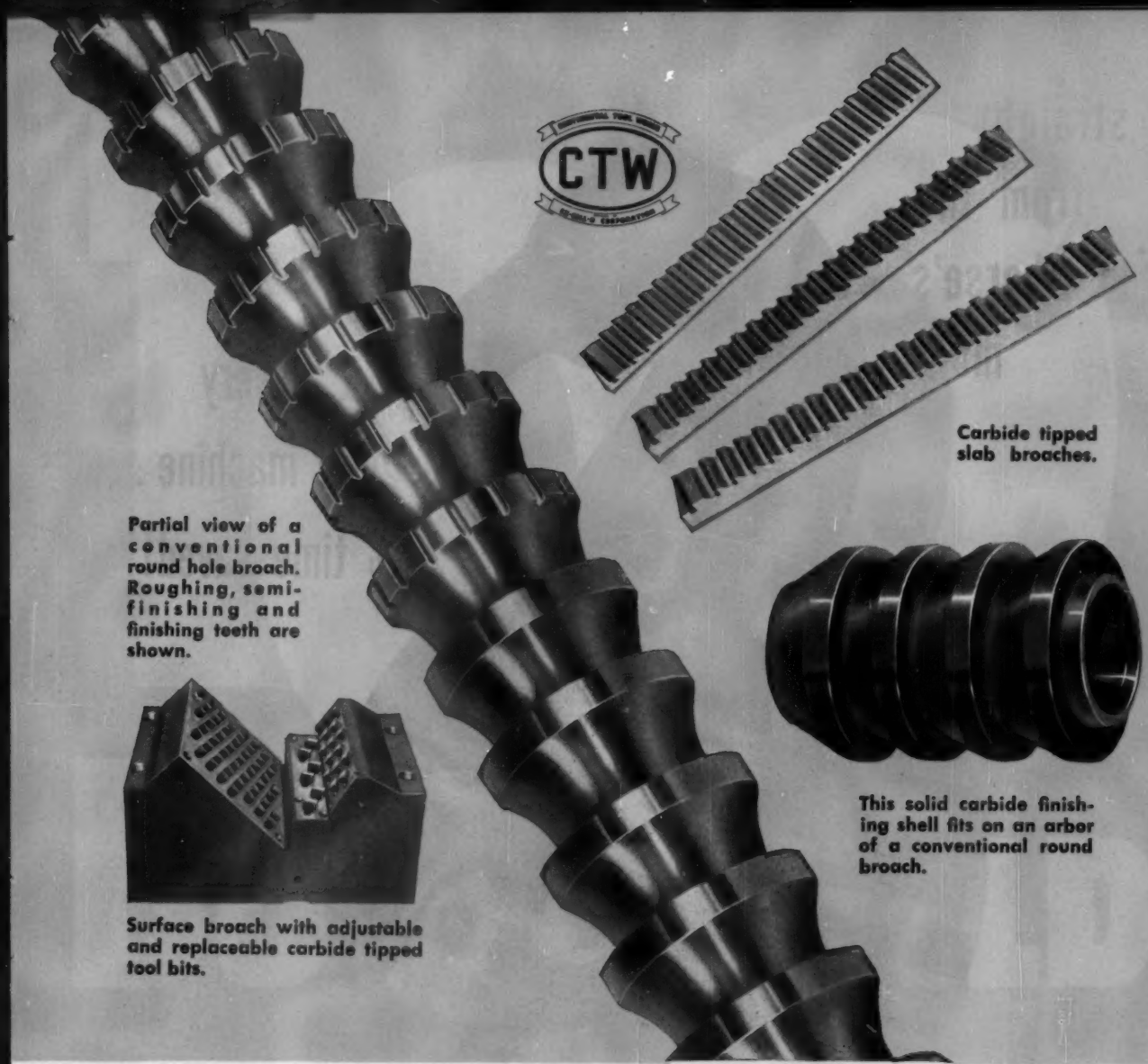
Concerning this J&L development, a customer writes: "We are tripling production on many of our items."

Write for descriptive folder No. 5440. JONES & LAMSON MACHINE COMPANY, 502 Clinton Street, Springfield, Vermont.

JONES & LAMSON TURRET LATHES

the man who needs a new machine tool is already paying for it

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools Thread & Form Grinders



Carbide tipped slab broaches.

Partial view of a conventional round hole broach. Roughing, semi-finishing and finishing teeth are shown.

This solid carbide finishing shell fits on an arbor of a conventional round broach.

Surface broach with adjustable and replaceable carbide tipped tool bits.

Here's Why Continental Quality Broaches Actually Cost Less Than Ordinary Broaches

After all, the price paid for a broach may be only the beginning of broaching expense. To the original cost of the broach must be added the cost of work delays, scrapped parts, and time-consuming adjustments.

However, if the broach is free cutting, holds the required tolerances and finishes, with the maximum pieces per tool, your original cost may be your only cost.

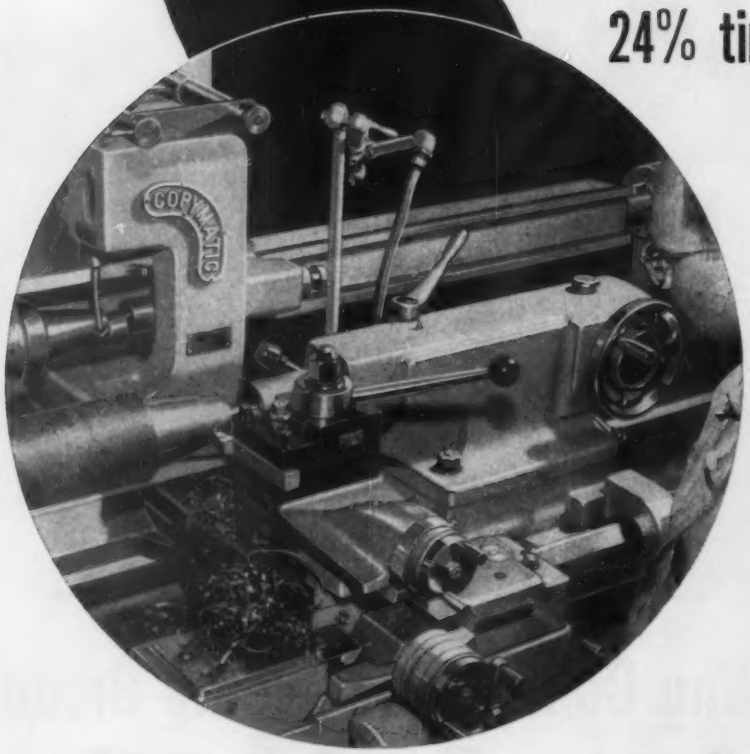
Because Continental effectively combines quality materials, skilled craftsmanship, and engineering experience, it is a fact: "the best broaches cost less."

Continental
TOOL WORKS
Division of
Ex-Cell-O Corporation
Detroit 32, Michigan

56-64

straight from the horse's mouth:

..."a very good machine... 24% time saved!"



When a famous machine tool manufacturer reports on the performance of another's product, it is an opinion you can count on as authoritative.

The Ingersoll Milling Machine Company of Rockford, Illinois is one of the early owners of a new Lodge & Shipley 16" POWERTURN 90° COPYMATIC Lathe. Used in turning cutter housings and shanks, shafts and spindles, the lathe has proved very good, judged on performance, construction, accuracy and versatility.

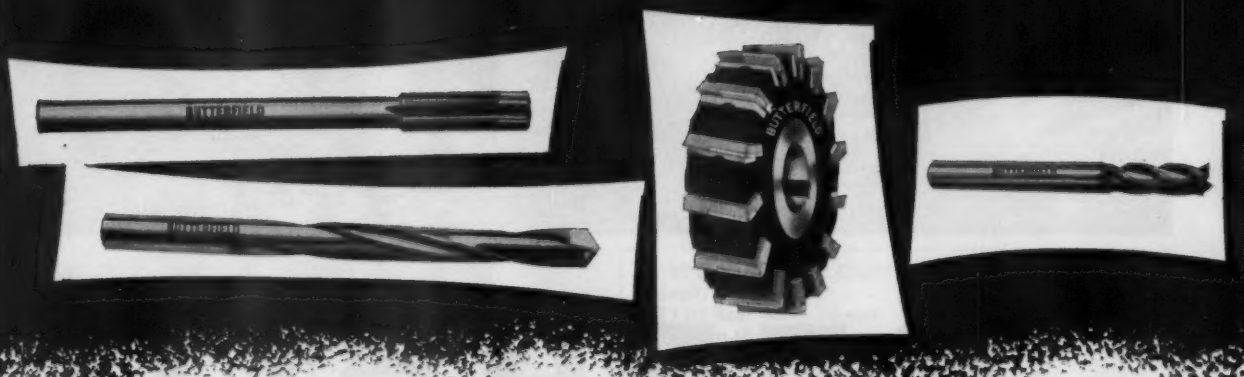
If you want eye-witness proof of similar significant savings on your lathe production, the Lodge & Shipley Demonstration Room is at your service. Contact your Lodge & Shipley distributor for details or write direct to: The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

JOB FACTS

WORKPIECE: 4" Diameter Cutter Housing
OPERATION: Turn complete including taper
MATERIAL: 4140 HR Steel
CUTTING TOOLS: Carbide
FEED: .018" per rev.
SPEED: 431 RPM
TIME: Floor-to-Floor: approx. 35 min.
RESULTS: 24% time saved

Lodge & Shipley

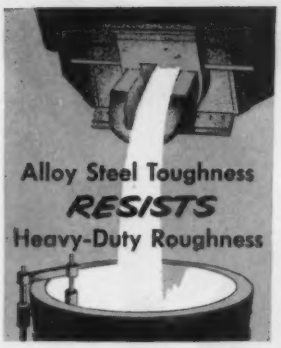
100% BUTTERFIELD



100% COMPLETE LINE . . . EVERY TOOL 100% INSPECTED . . . AND YOU GET

100% SERVICE FROM YOUR BUTTERFIELD DISTRIBUTOR

Butterfield also offers a complete line of taps, dies, drills, reamers, cutters, end mills and hobs. There are Butterfield warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York, San Francisco. **BUTTERFIELD DIVISION** • Union Twist Drill Company • **Derby Line, Vermont.**



DRIVE AXLE

Model "660" Motor Grader is built by Adams Division, LeTourneau-Westinghouse Company, Indianapolis, Ind.

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

DESIGNED FROM ALLOY STEEL

Shrugs Off Fatigue, Terrific Torque, High Impact Load

Motor graders built by Adams Division of LeTourneau-Westinghouse Company are known throughout the world for quality and dependability.

A good example of the company's constant effort to improve this quality and dependability can be found in the grader's full-floating, two-section drive axle—considered to be the most vulnerable part in the entire unit. It is subjected to terrific torque from an eight-speed, constant-mesh transmission. Impact load is often extreme.

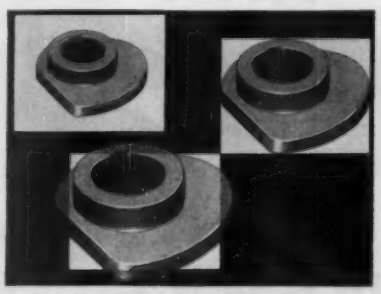
Company engineers and metallurgists spent thousands of hours on research and field testing of all types of steels to find one that would reduce ultimate fatigue in the axle to an absolute minimum.

They eventually settled on Republic Hot Rolled 4340 Alloy Steel. This fine steel not only resists fatigue, but also is able to take a high torque without a permanent set. Fatigue failure is now practically non-existent.

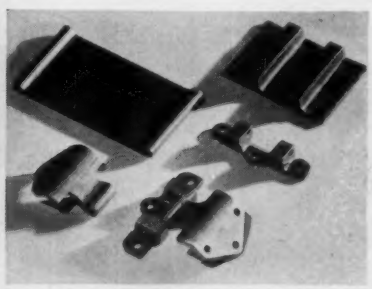
Alloy steels provide an outstanding combination of qualities essential to designing smaller sections to move or carry heavier loads with no sacrifice of strength or safety. They resist fatigue, shock and stress. Respond uniformly to heat treatment, producing hard, wear-resistant surfaces around tough cores. This tough, integral structure provides greater strength with minimum weight.

Specify Republic Alloy Steels for your jobs where strength and toughness must resist heavy-duty roughness. We offer you the services of our experienced field metallurgists to help you get the most from these versatile steels at the lowest possible cost. There's no obligation. Just mail the coupon.

COMPLETE DESIGN, engineering and fabricating facilities go to work for you as an extension of your plant when you have your stamped and drawn parts fabricated by Republic's Pressed Steel Division. This truck shaft bracket is one example of a wide variety of steel parts mass produced to specification at the lowest possible cost. Send coupon for Booklet Adv. 681.



DIE AND PART DESIGN PROBLEMS are reduced by 3 new grades of Republic Iron Powder with *Controlled Dimensional Factor.* In the presence of copper, these powders—depending on type—can be made to grow, remain stable, or shrink, within acceptable limits. Complete information on Type "G" for growth, Type "N" for normal, Type "S" for shrinkage are contained in Booklet Adv. 763. Write for it.



LIMITLESS FLEXIBILITY IN DESIGN is provided by Republic Special Sections. They simplify built-up, interlocking or associated parts. Machining time and costs are reduced to a minimum because the sections are preformed to the predominating cross section of the part. Available hot rolled or cold drawn in all grades of carbon, alloy and stainless steel. Send coupon for more information.

STEEL

and Steel Products

REPUBLIC STEEL CORPORATION
Dept. C-2829
3102 East 45th Street
Cleveland 27, Ohio

☐ Have an Alloy Steel Metallurgist call.

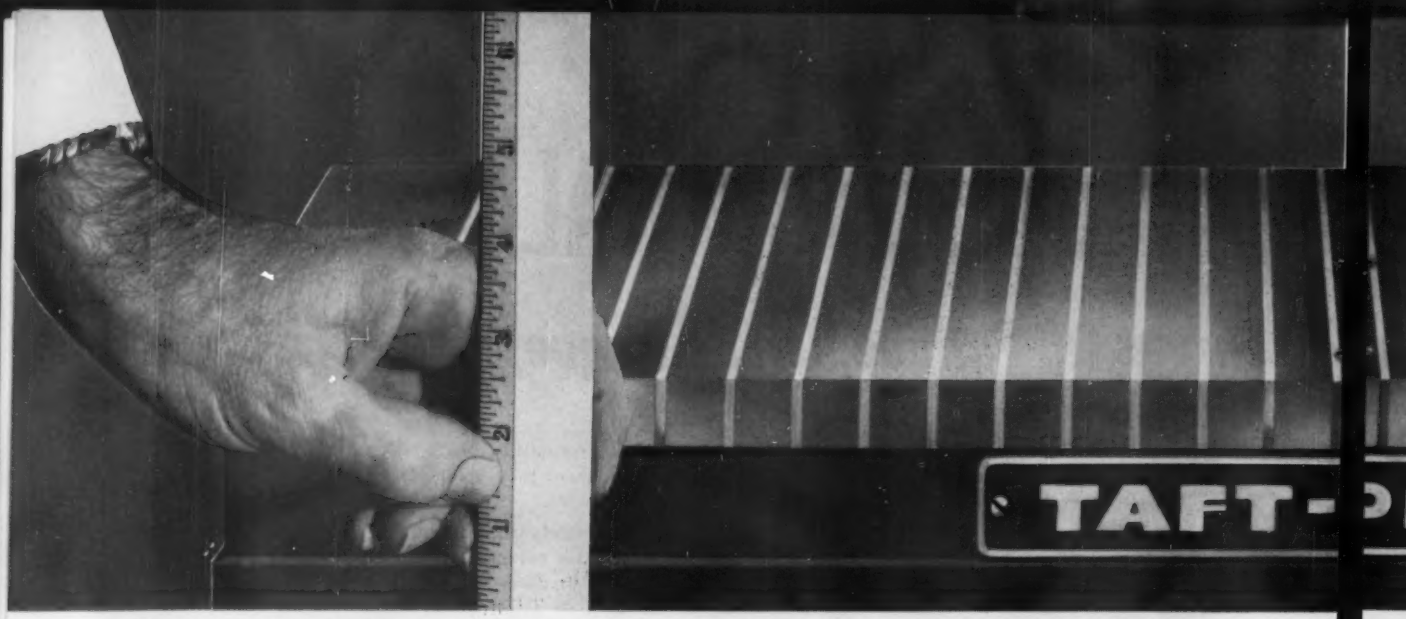
Send more information on:
☐ Stampings (Booklet Adv. 681) ☐ Iron Powder (Booklet Adv. 763)
☐ Special Sections

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____



❶ LESS THAN 2½" HIGH. New low-boy design increases work capacity between wheel and faceplate by 1" to 1½" over conventional 8" x 24" chucks . . . a natural for handling the big jobs.

new

TAFT-PEIRCE 824*

PERMANENT MAGNET CHUCK

Low . . . Powerful . . . Precise . . . Easy to use

❷ 28% MORE HOLDING POWER... specially engineered pack and concentration of flux gives extra holding power to handle practically all jobs, without complicated setups and with reduced costs.

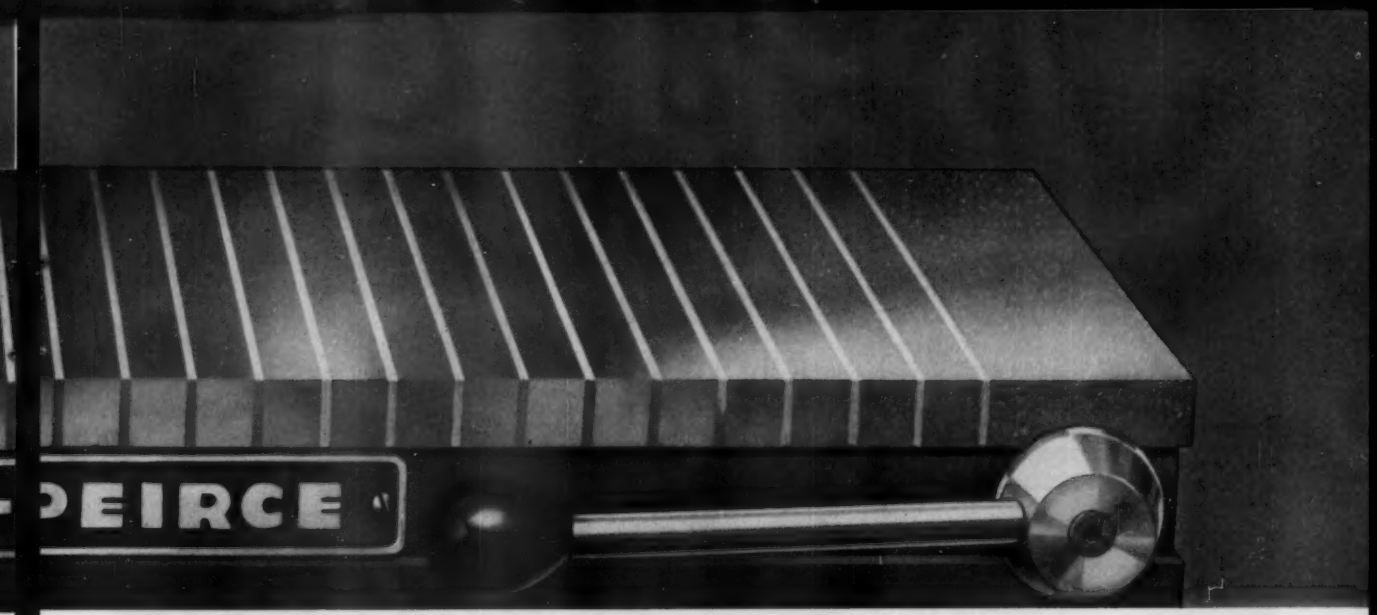
There's a lot of utility and cost saving packed into the new Taft-Peirce 824!

The 824 has been designed especially for *your* tooling and production requirements. Special Alnico V magnet design gives 100% all-over power, no dead spots — full edge-to-edge usable surface for ganging small parts or safely holding big ones. Holding power is better than ever — it's 28% stronger than comparable units.

Another big plus is the unique concept in faceplate design. New epoxy resin non-magnetic separators and special assembly techniques provide unusual stability and a much lighter chuck.

Check the many other shop tested features you see pictured on this page — a total of six exclusive advantages the new 824 brings to metalworking. The new 824 is ready now — through your nearest Taft-Peirce dealer or send your order to: The Taft-Peirce Manufacturing Co., Woonsocket, R. I.

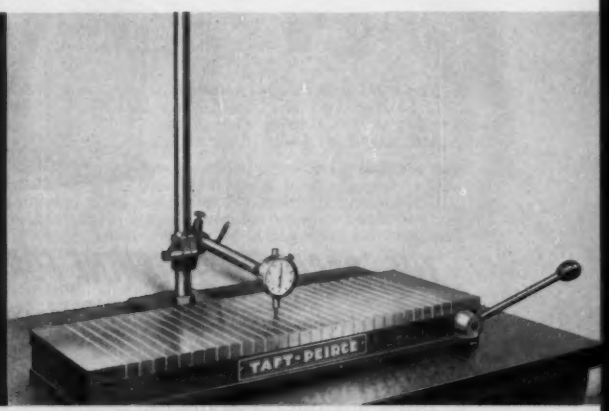
*PAT. APPLIED FOR



3 CHUCK DRESSES WITHOUT WHEEL LOADING... new type separators keep the wheel clean. Grinding operations are streamlined, and unproductive time is cut to the minimum.

4 NO MORE TROUBLE WITH RESIDUAL MAGNETISM... pack moves easily and quickly. With handle in "off" position, operator can get workpieces on and off the chuck in seconds.

5 27% LESS WEIGHT... than other chucks of the same size. Easy to handle — promotes greater utility, handy for ganging to handle big milling or grinding jobs.



6 PRECISE, ACCURATE SURFACE... faceplate uses production-proved epoxy resin separators. Surface is more stable—perfect for close tolerance work.

TAKE IT TO TAFT-PEIRCE

T-P Means TOP Precision

PAT. APPLIED FOR

Every day... *Everywhere*... Your Competitors are using

DEVLIEG *Spiramatic* JIGMILS®

for **ULTRA-PRECISION BORING and MILLING**

THE "ACCEPTED" MACHINE FOR JIGLESS PRODUCTION OR ONE-PIECE JOBS

The DeVlieg System of "JIGLESS BORING"— ★ Eliminates expensive jigs ★ Permits complete flexibility of product design ★ Insures interchangeable assembly of parts without hand fitting.

DeVlieg JIGMILS are widely used in toolrooms and experimental shops for machining all types of jigs, fixtures and experimental parts to precise limits of accuracy with a minimum of operator skill.

Come to Detroit
SEE A PRACTICAL DEMONSTRATION OF THE JIGMIL TECHNIQUE

DEVLIEG MACHINE COMPANY
Write for Illustrated Catalog

450 Fair Avenue • Ferndale
DETROIT 20, MICHIGAN

IN CUTTING-OFF OPERATIONS...

...SPEED WITHOUT ACCURACY IS COSTLY!

Efficient cut-off of steel blanks from bars demands a combination of speed *and accuracy*. MARVEL, and MARVEL alone, achieves this combination with machines capable of delivering feeds and speeds which fully utilize the strength and heat resistance of the modern high speed hack saw blade.

MARVEL dual power feed and crank lever method of reciprocation are two exclusive features designed to give increased speed and efficiency. This unique dual power feed employed on the Series No. 6 and No. 9 MARVEL Ball Bearing Hack Saw Machines, simultaneously controls both positive feed depth and feed pressure, automatically adjusting both pressure and depth of feed correctly in proportion to the number of teeth in contact with the work. This automatically forces the blade to cut as deeply as possible and practical on every stroke, without demanding the attention of the operator. As a result, the work is cut-off in the fewest possible number of strokes. Quick return of the saw frame on the non-cutting stroke, accomplished by the crank lever, delivers 33⅓% more cutting strokes per minute without increasing the blade velocity on the cutting stroke.

Accuracy is assured by the construction of the machine itself. Anti-friction ball or roller bearings are used at all load carrying points. The saw frame reciprocates on fully enclosed special design ball bearings which are factory adjusted with a pre-load, assuring permanent frictionless rigidity. Saw frame, saddle, and upright are precision machined and fitted to form a rigid integral unit capable of withstanding any cutting load with no deflection or side movement.

These exclusive features found only in MARVEL Hack Saw Machines, together with the unequalled performance of the unbreakable MARVEL High-Speed-Edge Hack Saw Blade, form a team that guarantees the fastest, most accurate cutting-off.

There is a MARVEL field engineer near you capable of intelligently discussing your cut-off work. Send for catalog C-55, and the name and address of your nearest MARVEL field engineer.

5-1300

ARMSTRONG-BLUM MFG. CO.
5700 WEST BLOOMINGDALE AVE. • CHICAGO 39, ILL.

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

℞ — *Fast Cure for BIG Complications . . .*

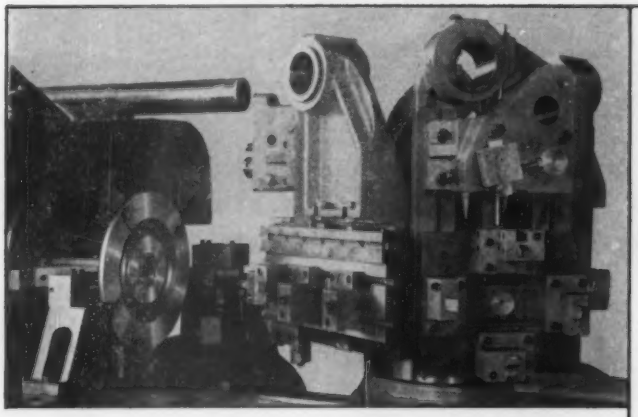
A SPECIAL P&J Treatment with STANDARD Tools

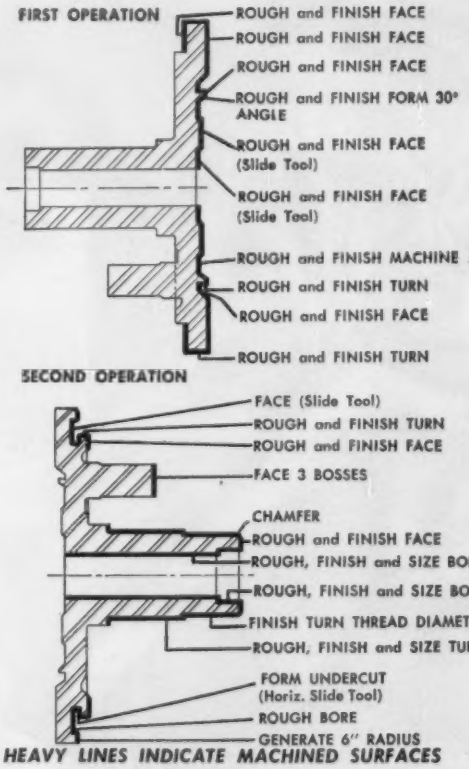
THE PART: A BIG (25-inch diameter) heavy, cast steel Pressure Plate Hub.

THE COMPLICATIONS: 42 separate roughing and finishing cuts involving very heavy stock removal. High accuracy and close concentricity required on *all* machined surfaces, and a fine micro-finish specified for two hub diameters!

THE TREATMENT: Take a big, powerful Potter & Johnston 10-U Automatic; team it with P&J-Engineered Tooling using *STANDARD*, basic tools.

THE RESULTS: Part finished quickly and economically according to specs in just over 47 minutes machining time . . . and tool costs kept to an absolute minimum.




FIRST OPERATION
ROUGH and FINISH FACE
ROUGH and FINISH FACE
ROUGH and FINISH FACE
ROUGH and FINISH FORM 30° ANGLE
ROUGH and FINISH FACE (Slide Tool)
ROUGH and FINISH FACE (Slide Tool)
ROUGH and FINISH MACHINE
ROUGH and FINISH TURN
ROUGH and FINISH FACE
ROUGH and FINISH TURN
SECOND OPERATION
FACE (Slide Tool)
ROUGH and FINISH TURN
ROUGH and FINISH FACE
FACE 3 BOSSES
CHAMFER
ROUGH and FINISH FACE
ROUGH, FINISH and SIZE BORE
ROUGH, FINISH and SIZE BORE
FINISH TURN THREAD DIAMETER
ROUGH, FINISH and SIZE TURN
FORM UNDERCUT (Horiz. Slide Tool)
ROUGH BORE
GENERATE 6" RADIUS
HEAVY LINES INDICATE MACHINED SURFACES

Performance like this is no exception; it's just one more example of the way a Potter & Johnston Automatic Chucking Turret Lathe can take problem parts in stride. If you're looking for new standards of speed and economy, make it a standard practice to put your complicated jobs on a P&J Automatic with P&J Tooling. In addition to the big 10-U used to machine this massive pressure plate hub, P&J produces a complete line of Automatics for every work size requirement, so send for complete information today.

Write today for complete information . . . or phone the Pratt & Whitney Branch Office near you, and ask a Direct-Factory Representative to call and discuss your requirements. **Potter & Johnston Company, Pawtucket, Rhode Island (Subsidiary of Pratt & Whitney Company, Incorporated).**

POTTER & JOHNSTON

Precision Production Tooling for more than Fifty Years

AUTOMATIC TURRET LATHES • NEWARK GEAR CUTTERS

ARMSTRONG WRENCHES

Choose Your Wrenches as you do your friends--for life

Specify ARMSTRONG Wrenches for lifetime service, for finely balanced tools that feel right in the hand and make work easier, faster and less fatiguing. ARMSTRONG Wrenches generally are longer for size—give greater leverage. Accurately milled or broached openings give the proper clearance. They are safe wrenches because they are strong beyond need.

Drop forged and machined from high tensile carbon or special alloy tool steels, ARMSTRONG Wrenches are heat treated, tempered and tested to an exact balance of toughness, hardness and tensile strength. Each is beautiful in finish and line, is a quality tool to be proudly possessed by any mechanic—or certain to "give a lift" to any assembly line. Buy wrenches which carry the trade marks HI-TEN or ARMALOY. On carbon or alloy steel wrenches these trade marks are your guarantee of lifetime quality.

WRITE FOR CATALOG

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"*
5215 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

Now – Cleveland provides a single source for all your socket screw requirements

Simplifies specification, cuts paper work, speeds delivery

CLEVELAND STANDARD SOCKET SCREW PRODUCTS
UNIFIED THREADS—CLASS 3A FIT

Type	Standard Sizes (diam.)	Material
Socket head cap screws	#0 to 1½ in. (larger sizes avail.)	Alloy steel, heat treated or Nonmagnetic 18-8 stainless
Set screws (cup, half dog, flat, cone or oval points)	#0 to 1 in. (#0-#3, cup point only)	Alloy steel, heat treated or Nonmagnetic 18-8 stainless (to ½ in., cup point only)
Flat head socket cap screws	#4 to ¾ in.	Alloy steel heat treated
Button head socket cap screws	#4 to ⅝ in.	same
Shoulder screws (stripper bolts)	¼ to ¾ in.	same
Dowel pins	⅛ to 1 in. (nominal size and .001 in. oversize for repair)	same
Pressure plugs	⅛ to 1¼ in. NPTF	same
Socket screw keys	.028 to 1 in. across flats; short or long arm	same

Cleveland has expanded its socket screw line to provide a single source for all your socket head needs.

At the same time, and in conjunction with opening its new plant, Cleveland is doubling its factory warehousing capacity. This, plus the latest materials handling equipment, will enable Cleveland distributors to get same-day shipment of your larger orders.

Included in the expanded Cleveland socket screw line are precision dowel pins. While not a socket head product, they are basic fasteners for the important tool and die industry, where they are closely associated with socket head cap screws and shoulder screws. We offer them as part of a complete service.

Cleveland socket head cap screws are upset forged from heat-treated alloy steel. This results in symmetrical, unbroken grain structure in heads, threads and fillets—greater fatigue and tensile strength, stronger fasteners.

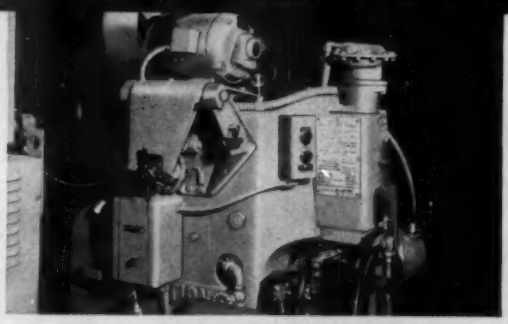
Write for latest literature and technical data. Then see your local Cleveland Cap Screw distributor for all your socket screw requirements.

THE CLEVELAND CAP SCREW COMPANY
4444-3 Lee Road, Cleveland 28, Ohio

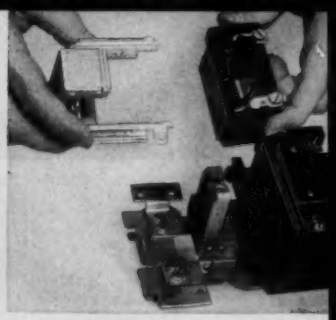
Where to use
3 KINDS OF G-E MAGNETIC STARTERS
and why . . .

NON-REVERSING STARTERS—for all full-voltage, single-speed motor applications

When remote control is desired, or when motors are started and stopped frequently —such as on machine tools, compressors, blowers, or similar equipment—use G-E magnetic starters. The strongbox coil is layer-wound with insulated wire, and impregnated with a solventless varnish. The windings are enclosed in a molded case which keeps out moisture and oil, and helps protect against accidental damage.



NON-REVERSING STARTER ON WELDER

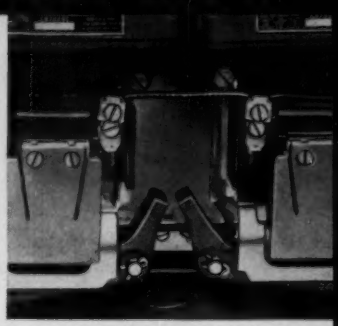


STRONGBOX COIL

REVERSING STARTERS—for control of motors which rotate in both directions

To control motors which reverse direction —on hoists, door openers, and planers, for example—select G-E reversing starters. They consist of two separate starters in a single case, with an interference-type mechanical interlock which prevents short circuits caused by one starter closing before the other starter opens the circuit. Extra electrical interlocks are also available.

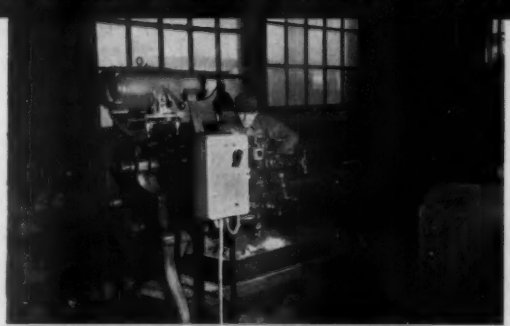
REVERSING STARTER ON OVERHEAD DOORS



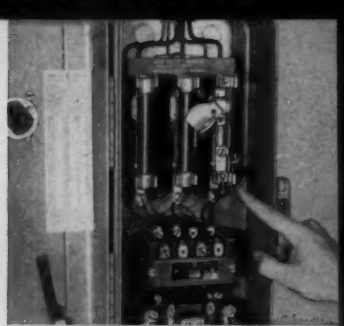
MECHANICAL INTERLOCK

COMBINATION STARTERS—for starter and short-circuit protection in one unit

G-E combination starters—which come in both reversing and non-reversing forms—have the extra feature of a fusible, or non-fusible disconnect switch, or circuit breaker for short-circuit protection and manually disconnecting the motor from the line. Interchangeable fuse clips provide maximum flexibility, enable you to adapt your starter to new circuit conditions. 731-5



COMBINATION STARTER ON TURRET LATHE



DISCONNECT SWITCH

FOR ANY APPLICATION—specify General Electric for best quality, most reliability

For further information write for bulletin GEC-1260, or contact your nearest General Electric Apparatus Sales Office or Distributor.

GENERAL ELECTRIC

BLOOMINGTON, ILLINOIS

How can you bear being up a tree?

If grinding wheel problems have you in a bearish mood—or even out on a limb—stop growling. Switch to CINCINNATI (PD)° WHEELS. For *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—a remarkable achievement in precision manufacturing and quality control that can *save you money* . . . and *increase your production.*

Through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

So, if you want the bare, down-to-earth facts on how to save money and increase production, contact your CINCINNATI Grinding Wheels distributor. Or, contact us direct and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

Remember—*only* CINCINNATI Grinding Wheels give you . . .

(PD) POSITIVE DUPLICATION

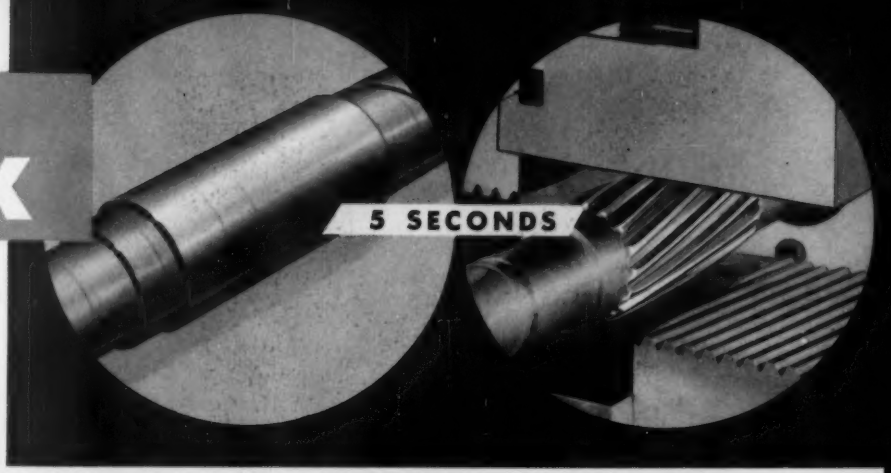
CINCINNATI° *Grinding Wheels*

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

°Trade Mark Reg. U. S. Pat. Off.

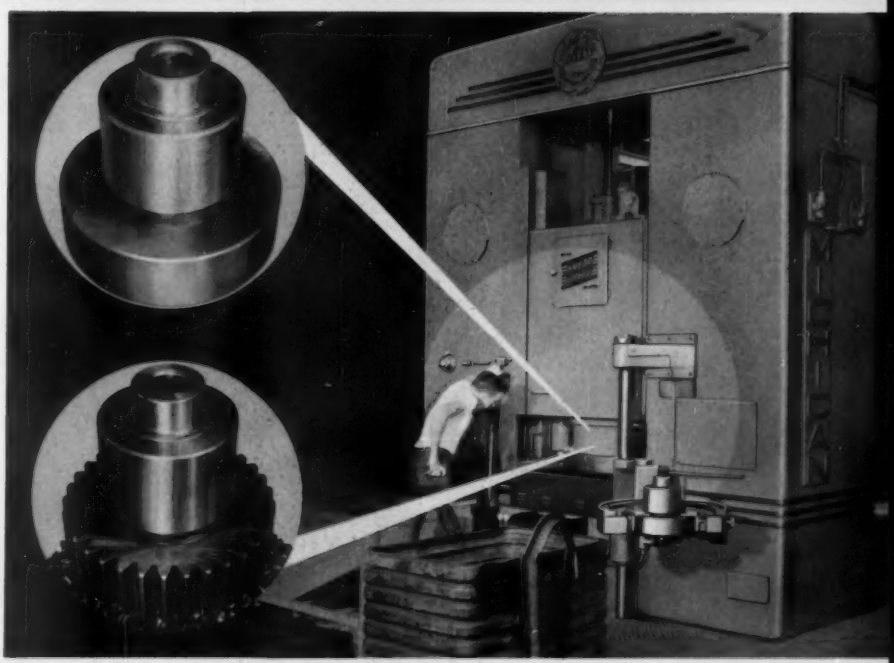
This Month's

GEAR PIX



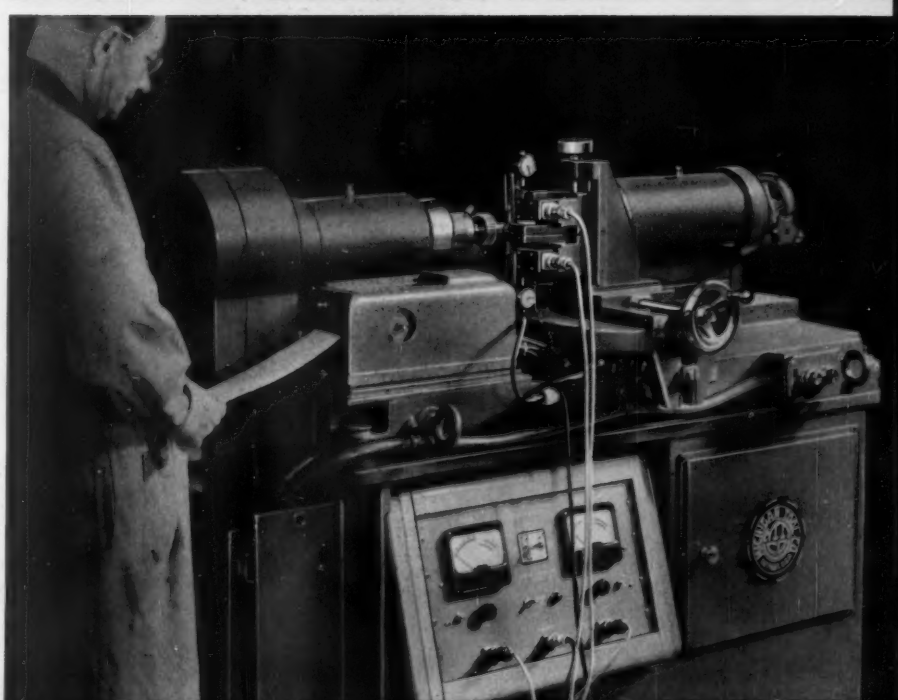
SPLINE ROLLING IN ONLY 5 SECONDS . . .

. . . That's all it takes to roll-form this helical spline with the Michigan Roto-Flo "chipless production" process. Floor-to-floor time, with automatic loading, is 17 seconds. Cold metal displacement produces required dimensions from blank diameters less than the PD and OD. As accurate as machining, the process produces superior surface finishes. Want more data? Just ask for our application Bulletin RF-55.



GEARS FOR ROADBUILDING EQUIPMENT . . .

. . . are readily cut on this automatically cycled Michigan Shear-Speed. The heavy 33-tooth gear shown (3¾-in. face width) is produced at 5½ pieces per hour, removing over 10 lbs. of SAE 8622 steel as chips. Cutting speed is 17 fpm. Let us send you Bulletin SS-55 telling the full story of large gear shaping.



AUTOMATIC CHECKER FOR HIGH PRECISION GEARS . . .

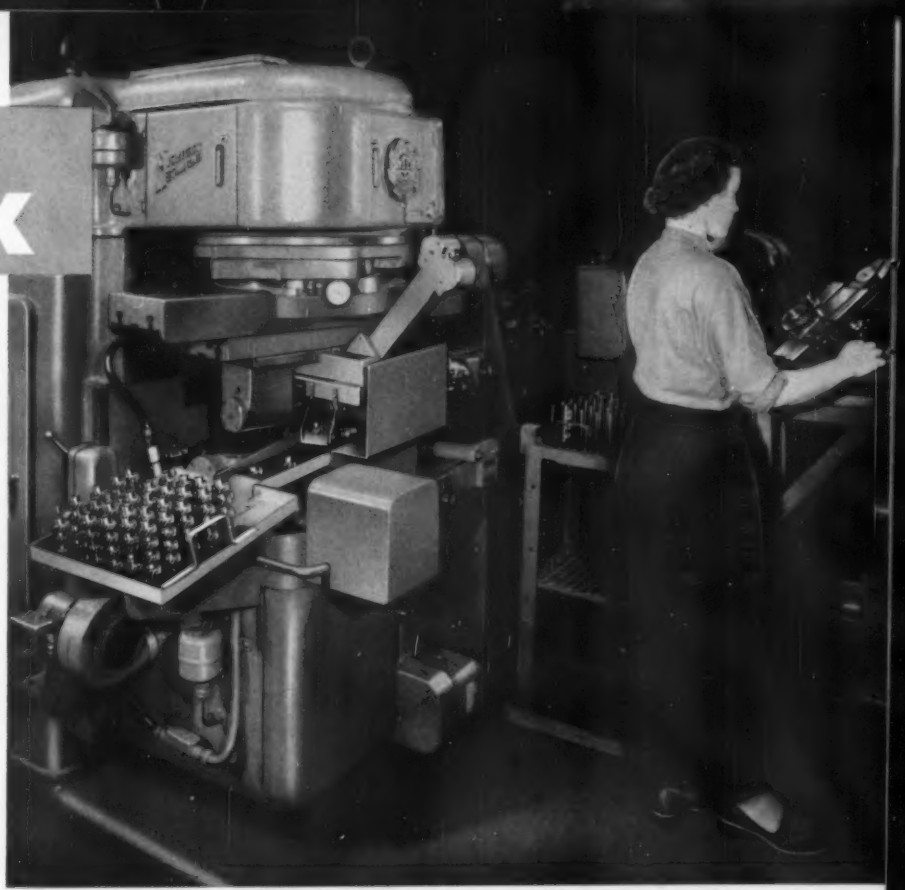
. . . designed particularly for aircraft and special-purpose spur gears. Cuts time needed for checking and recording parallelism, tooth taper and tooth spacing to 16% of normal. Handles gears from ¼ to 2½-inch face width and up to 14 inches diameter. Readings are automatically and permanently recorded by a built-in recorder for easy comparison. Ask for Bulletin 481-A.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

This Month's

GEAR PIX



AUTOMATIC LOADING UPS GEAR SHAVING OUTPUT . . .

. . . and releases the operator for preliminary gear checking. Mechanical loaders on standard machine tools (shown here: a Michigan Gear Shaver) offer a middle ground of automation that pays off immediately in output per machine-hour without increasing the work load of the operator. It's also safer.

READY SOON— A TANDEM HOBBER . . .

. . . latest addition to the Michigan line of hobbers features self-contained checker, automatic size control, loading and unloading, and chip disposal. You'll be able to set two or more of these hobbers in series for continuous through-feeding of parts. Literature coming off press soon—drop us a line now.

FROM RESEARCH— BETTER MACHINES, BETTER GEARS . . .

. . . Michigan machines and tools of tomorrow—for the controlled-quality, easier-made gears and splines to come—will owe much to the work of our research staff. This stepped-up development activity, now housed in new facilities (one section of which is shown), will carry on the scientific study basic to gear progress. New methods, machines and tools are sometimes the best answer to requirements of a particular manufacturer. If you have a problem in the area of gear and spline production, we will be glad to talk it over.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

Costs Reduced
Quality Improved

The many production advantages and cost reducing virtues of "AMERICAN" Hole Wizards are disclosed by bulletin No. 325.

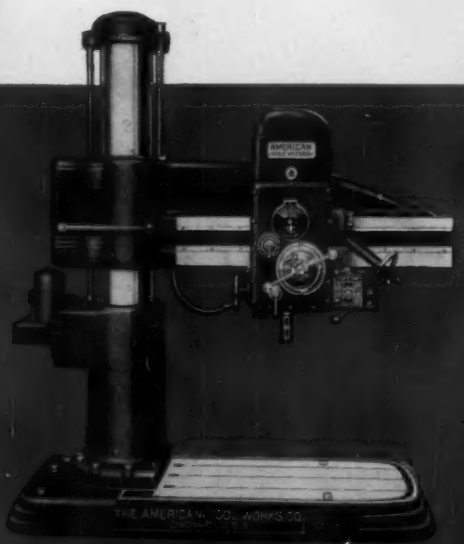
Wayne Manufacturing Company
Pomona, California
Newark, New Jersey

world's largest producer of

POWER SWEEPERS
for Cities and Industry

. . . cut drilling and boring costs over 50% with an "AMERICAN" Hole Wizard Radial and improved the quality of the work.

Using an assortment of well designed drilling, boring, reaming, tapping, spot-facing and chamfering tools in combination with the "AMERICAN" Hole Wizard's power, rigidity and predominant ease of operation, spectacular savings have been recorded over previous horizontal boring mill methods.



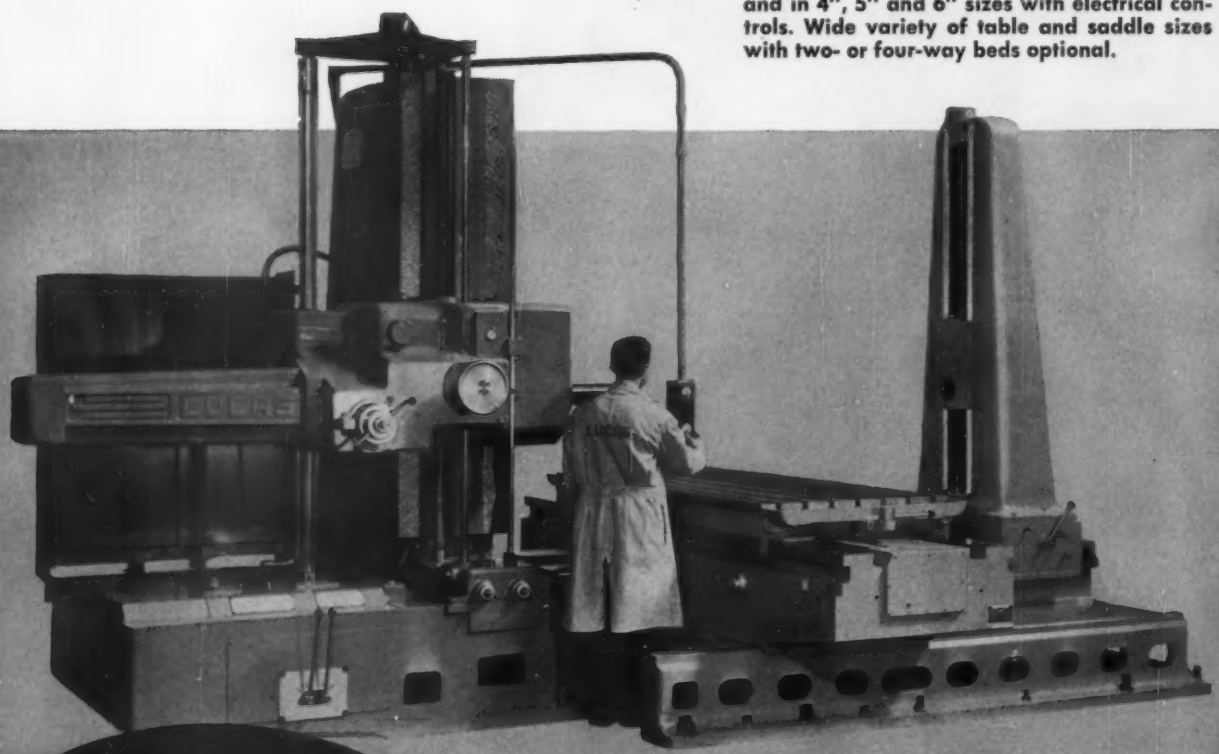
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

there's always work for a Lucas

Extreme accuracy, feather-touch pendant control, automatic power positioning for repetitive work make a Lucas the most useful machine in any shop. There's a model and size for *your* horizontal boring, drilling and milling operations. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.

A complete range of models, built in 3", 4" and 5" spindle sizes with mechanical controls and in 4", 5" and 6" sizes with electrical controls. Wide variety of table and saddle sizes with two- or four-way beds optional.



LUCAS OF CLEVELAND

A DIVISION OF THE NEW BRITAIN MACHINE COMPANY

Other New Britain Machine Tool Divisions

New Britain-Gridley Machine Division
New Britain, Connecticut

Hoern & Dilts Division
Saginaw, Michigan

12 spindle speeds, instantly selected with direct-reading, color match dial.

All-geared spindle drive transmission.

Totally enclosed quick change gear box. 48 or 54 thread-feed changes.

Ground and flame hardened bedways insure years of accurate service.

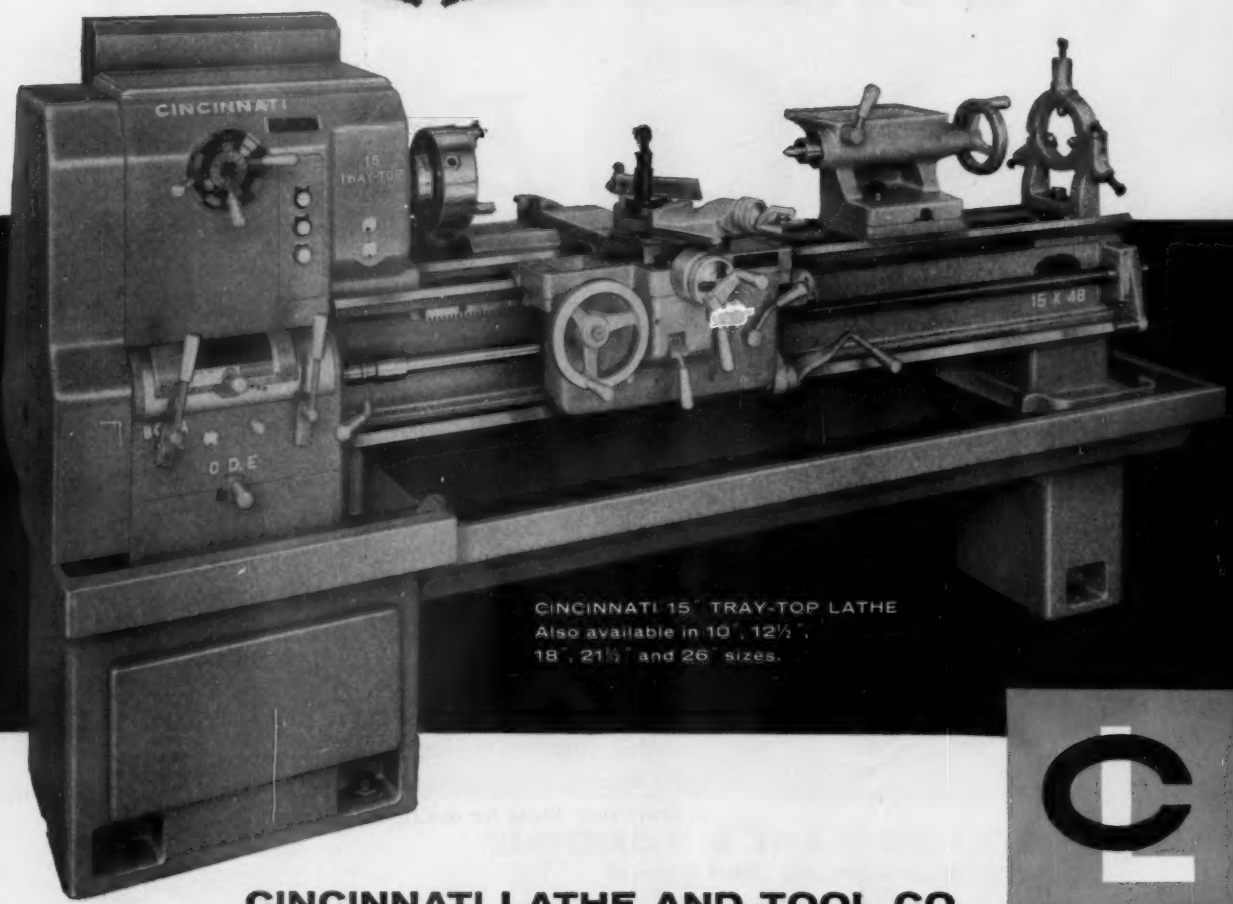
Hardened steel gears in all 3 transmissions assure long-life operation.

Fully enclosed electrical controls increase operating ease and safety.

Tray-Top Lathes give you many other features normally found only on larger, more expensive lathes. For all the facts and features, see your Cincinnati dealer. Send today for catalog data.

Because it's a CINCINNATI TRAY-TOP LATHE

more goes into it... you get more out of it!



CINCINNATI 15" TRAY-TOP LATHE
Also available in 10", 12½", 18", 21½" and 26" sizes.

CINCINNATI LATHE AND TOOL CO.

3207 Disney Street, Cincinnati 9, Ohio

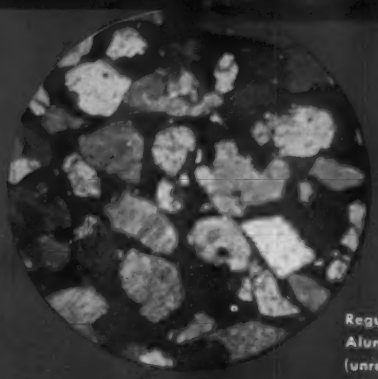
Builders of Engine, Toolroom and Fixed Gap Bed Lathes and a Complete Line of Drilling Machines

NEW in toughness

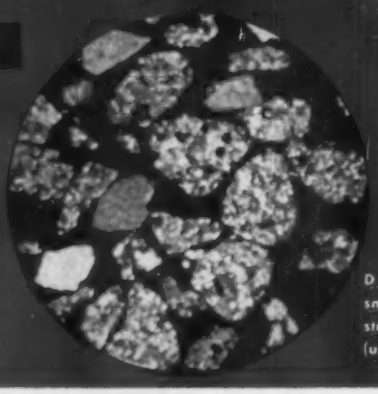
NEW in cutting action

NEW in grinding economy

NEW



Regular Aluminum Oxide (unretouched)



D A Borolon smaller crystal structure (unretouched)

SIMONDS

DA *Borolon*® TRADE MARK

for resinoid bonded snagging wheels

A big forward step to new efficiency in grinding steel mill billets and foundry castings. Note the smaller crystalline structure of DA Borolon within each abrasive cutting particle! This means inherent toughness to resist fracture during grinding stress . . . more and sharper cutting edges on the wheel face . . . longer, useful wheel life . . . and more production per wheel dollar. Test after test on swing frames, floor stands and portables prove that Simonds wheels with this new aluminum oxide abrasive belong on your grinders for more production at lower cost. Write for descriptive bulletin.

NEW LIFE

for more grinding . . .

SIMONDS ABRASIVE CO.

GRINDING WHEELS

with DA Borolon®

TRADE MARK

CALL YOUR SIMONDS DISTRIBUTOR

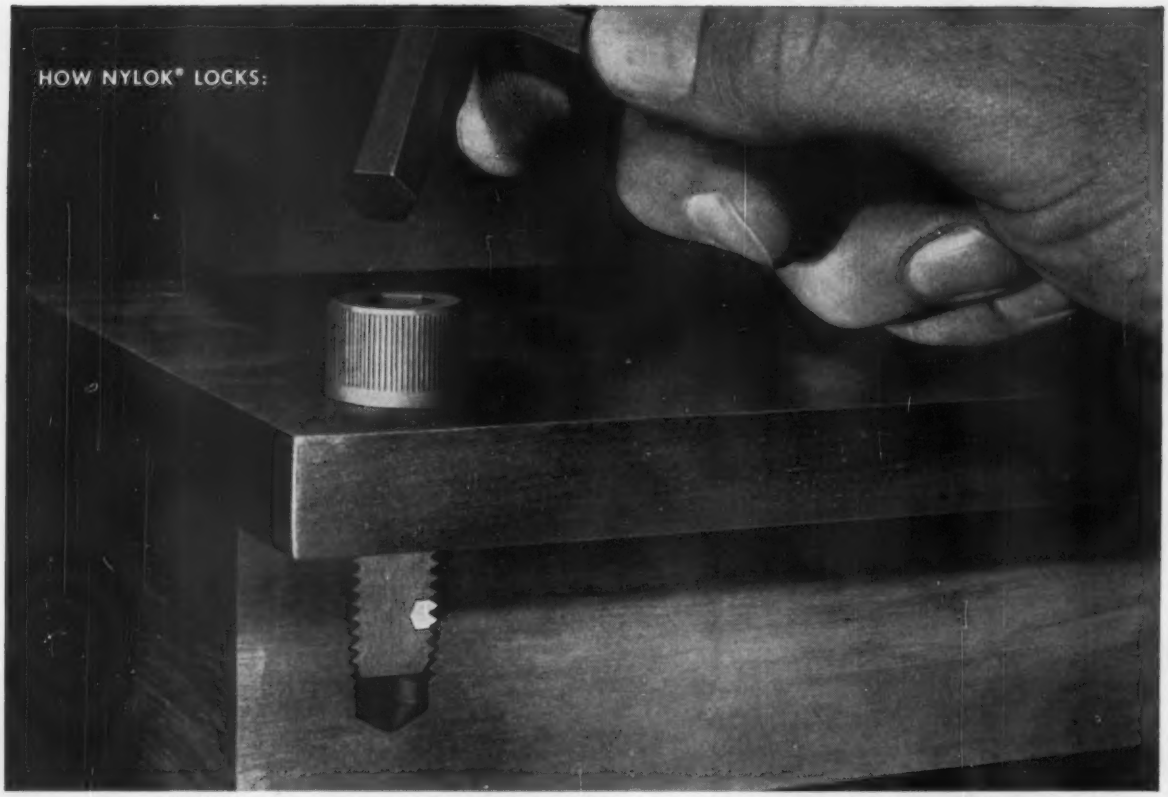
LOCAL STOCK FAST SERVICE

SIMONDS ABRASIVE COMPANY

Tacony & Fraley Sts., Philadelphia 37, Pa.

DIVISION OF SIMONDS SAW AND STEEL CO.

BRANCHES: PHILADELPHIA, CHICAGO, DETROIT, LOS ANGELES, SAN FRANCISCO, PORTLAND, ORE.



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together, and locks the screw securely.

NEW—a complete line of self-locking UNBRAKO socket screw products that won't work loose

They simplify design and save production time

UNBRAKO socket screws are now available embodying the Nylok* self-locking principle. Nylok provides a truly practical new solution to the problem of making screws self-locking.

You save production time when you build products with self-locking UNBRAKOS. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. So are cotter pins and complex multiple set screw installations.

Self-Locking UNBRAKOS are completely reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, on properly seated screws, the pellet acts as a liquid seal.

Self-locking UNBRAKO socket screws come in a complete range of standard sizes and materials. See your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

T.M. Reg. U.S. Pat. Off., The Nylok Corporation

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

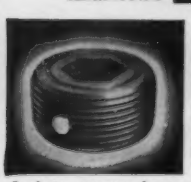
JENKINTOWN PENNSYLVANIA

Socket head cap screws. Standard sizes #6 to 1 in.

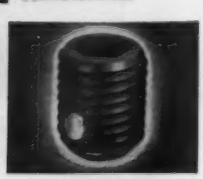
Socket shoulder screws. Standard sizes ¼ to ¾ in.

Flat head socket screws. Standard sizes #6 to ¾ in.

Button head socket screws. #6 to ⅝ in.



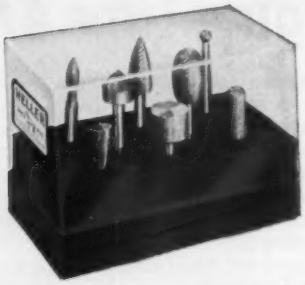
Socket pressure plugs. Standard sizes ⅛ to 1¼ in.



Socket set screws. All standard point types. #6 to 1 in.

get longer life with

HELLER ROTARY FILES



Popular Assortments of HELLER Rotary Files available in four different combinations of Hand Cut and Ground-From-Solid.

Special analysis, high quality steel, plus precision manufacture make each HELLER Rotary File last longer—and cut faster. HELLER'S Regrinding Service restores them to service at a fraction of their original cost—thereby extending their useful life and saving you money.

Available in a full range of shapes and sizes, HELLER'S complete line includes Handcut, Ground-from-solid, Carbide Burr and Miniatures.

For more than 100 years HELLER has been first in files. Now you can get HELLER quality in any type of file you need.

Write for Catalog R-48 for Rotary File information.

HELLER TOOL CO. SINCE 1836

NUCUT® American Pattern FILES

HELLER American Swiss® FILES

VIXEN® Milled Curved-tooth FILES

HELLER TOOL CO.

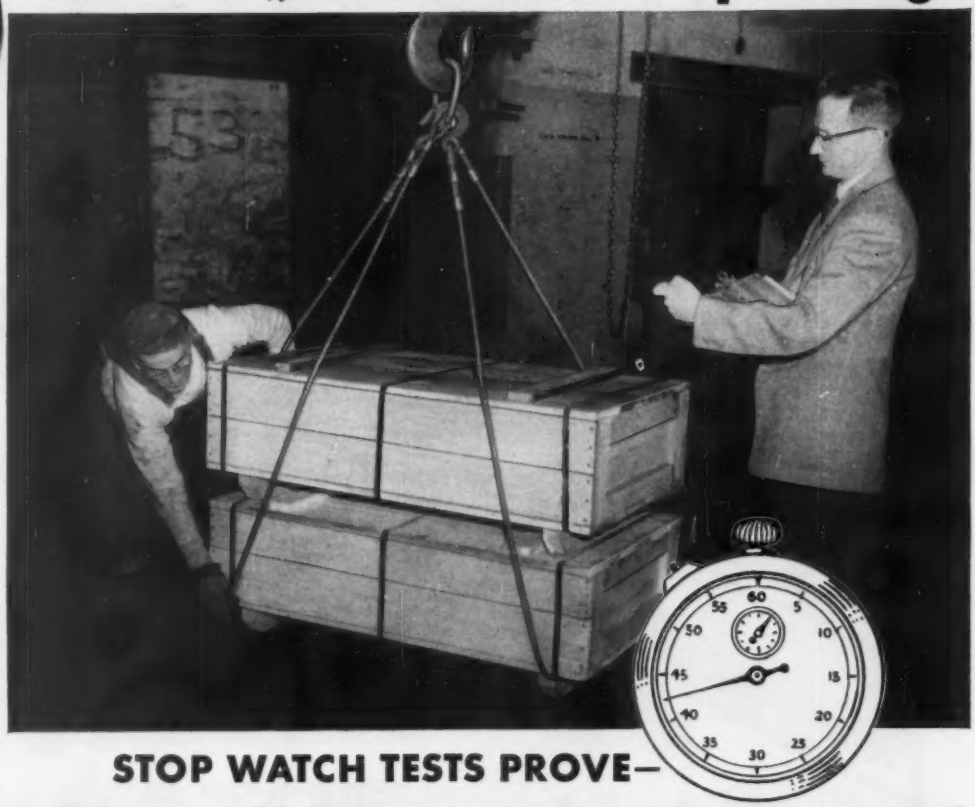
A Subsidiary of Simonds Saw and Steel Co.

NEWCOMERSTOWN, OHIO

Branch Offices: New York • Detroit • Chicago • Los Angeles

YOUR HELLER DISTRIBUTOR CAN SUPPLY ALL YOUR FILE NEEDS

ACCO Registered* Wire Rope Slings



STOP WATCH TESTS PROVE—

Cable-Laid Slings Cut Rigging Time 47%

• An eastern manufacturer ran time and motion studies on handling the two heavily loaded crates shown above. He found that his riggers could cut their time 47% when Cable-Laid Slings were used, instead of slings of standard construction.

For Cable-Laid Slings combine the flexibility of manila rope with the strength of steel. To this flexibility they add extreme resistance to kinking, and freedom from crankiness. As a result they are easy to handle—cut operating time. And they keep their ease of handling long after slings of standard construction are kinked and snarled to the point of uselessness.

This performance is possible only because of the combination of a special wire rope construction with ACCO's patented DUALOC ending. GALACCO coating, an ACCO exclusive, keeps Cable-Laid Slings bright and clean and imparts maximum corrosion resistance.

SAFEST SLINGS MADE • When you buy an ACCO *Registered* CABLE-LAID SLING, you are getting safeguards that make them the safest slings you can find.

Each individual component, made from the highest quality material suited to its use, is tested before assembly. It must prove to have strength equal to or greater than the sling body. These components are then assembled into slings according to precisely-engineered designs which have proved their safety and reliability in extensive field tests.

Each completed sling is then proof-tested at twice the load-carrying capacity for which it is rated. Then, and only then, does it receive the coveted ACCO registration certificate and tag.

Get the details on Cable-Laid, or any other ACCO *Registered* Wire Rope Slings, from your distributor—or call the nearest ACCO district branch below.

FREE FOLDER • Write Wilkes-Barre office for your copy of new folder **DH-532**, which gives strengths and weights (for six different lifts) on a full size range of ACCO *Registered* Cable-Laid Slings.

*Trade Mark Registered

ACCO

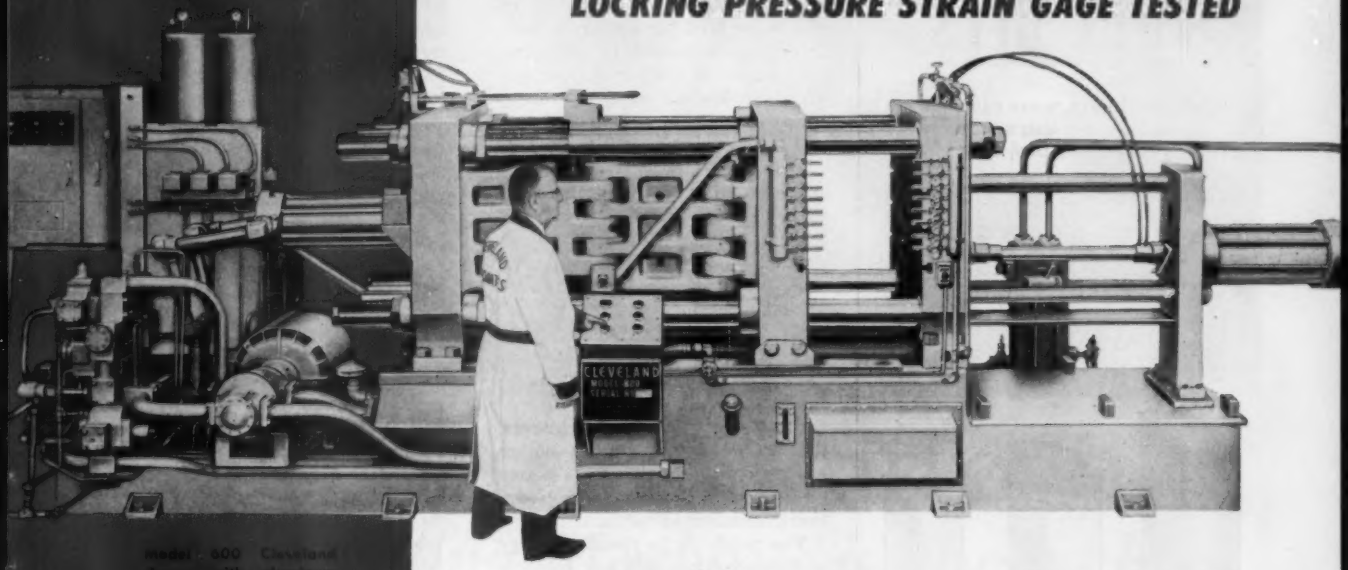
American Chain & Cable Company, Inc., Wire Rope Sling Department

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn. In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

MODEL 600 GREATEST CLEVELAND YET!

New 600-Ton Universal Hydraulic Die Casting Machine

LOCKING PRESSURE STRAIN GAGE TESTED



Model 600 Cleveland shown with aluminum shot end. Also available as a hot chamber machine. Has 46½" x 46" die plates; 24" x 28" space between tie bars; 30" max.—10" min. die thickness; 8" - 15" die opening.

Write for Bulletin 600

You're looking at the finest 600-ton die casting machine available today! The new Model 600 Cleveland was designed in every detail to give the die casting industry a machine of exceptional performance capabilities . . . high speed, reliable operation . . . safe and simple control . . . minimum maintenance. The developed machine more than met these specifications.

This new Cleveland will deliver castings weighing up to 10 lbs. aluminum, 25 lbs. zinc. An idea of the brawn built into the design—to back up its guaranteed 600-ton locking pressure—is indicated by the 38,000 lbs. net weight of the cold chamber machine shown above. Massive toggle system, 5" dia. tie bars and cross head guide bars, 7¾" thick platens, insure rigidity and accurate die alignment.

The hydraulic system is practically as leak-proof as can be built. Manifold valving is incorporated. Total pump capacity is 99 gpm. A 200 gal. oil reservoir is provided. Filter capacity is twice pump capacity. Two accumulators provide high injection speed.

Dozens of other highly important features—many are exclusively Cleveland's—are incorporated. You'll want to call in a Cleveland sales engineer for full details. In the meantime, factual information, well illustrated, in Bulletin 600 will give you plenty of incentive to reserve floor space for this new Cleveland in your shop. Write now for your copy.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4928 Beech Street
Cincinnati, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

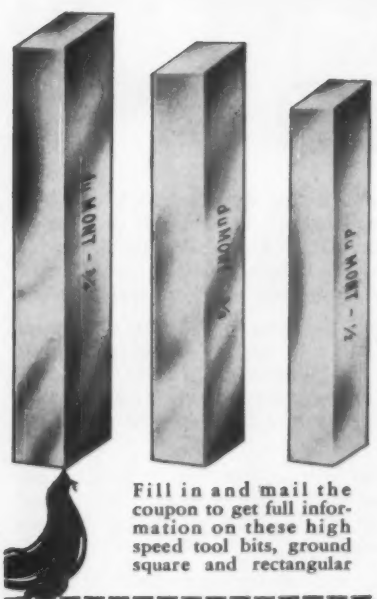
BALANCE

The *precise* reason for buying

du MONT TOOL BITS

with toughness, wear resistance and heat resistance in precise balance, they

HOLD A KEENER CUTTING EDGE LONGER



Fill in and mail the coupon to get full information on these high speed tool bits, ground square and rectangular

The du MONT CORPORATION, Greenfield, Mass.

MAIL FREE Tool Bit COMPARISON CHART, CATALOG and PRICE LIST A to

Name.....

Company.....

Address.....

Letters...

To American Machinist
330 W 42nd St, N Y 36, N Y

How Many Teeth?

Your article, "How Many Teeth for the Best Milling Cutter?" (*AM*—Nov 5 '56, p118) describes a series of tests involving milling of an annealed medium steel in which the feed per tooth was progressively increased by reducing the number of teeth in the cutters while holding all other operating conditions constant. It was found that when this was done the specific cutting energy was reduced approximately 23% as the feed per tooth was increased by a factor of twelve (from .0053 ipt to .0636 ipt). It was also observed that, with a standard surface-finish checking instrument, the surface finish did not change greatly as the feed per tooth was increased. No cutter life tests were conducted.

From these brief experiments, the article infers that a cutter having one or two teeth is better than a cutter having the conventional number of teeth.

The reduction in specific energy with increasing feed per tooth is well-known and has been observed for a long time. This reduction in specific energy was noted by C J Oxford, Sr and J Airey and reported in their paper "On the Art of Milling" published in 1921. The amount of reduction of specific energy with increasing feed per tooth in milling has been further evaluated experimentally by O W Boston, W W Gilbert, and A O Schmidt, who found reductions as great as, or greater than, those reported in the article. In recent years this reduction in specific energy has been explained as a size effect due to dislocations in the metal structure by M C Shaw and others.

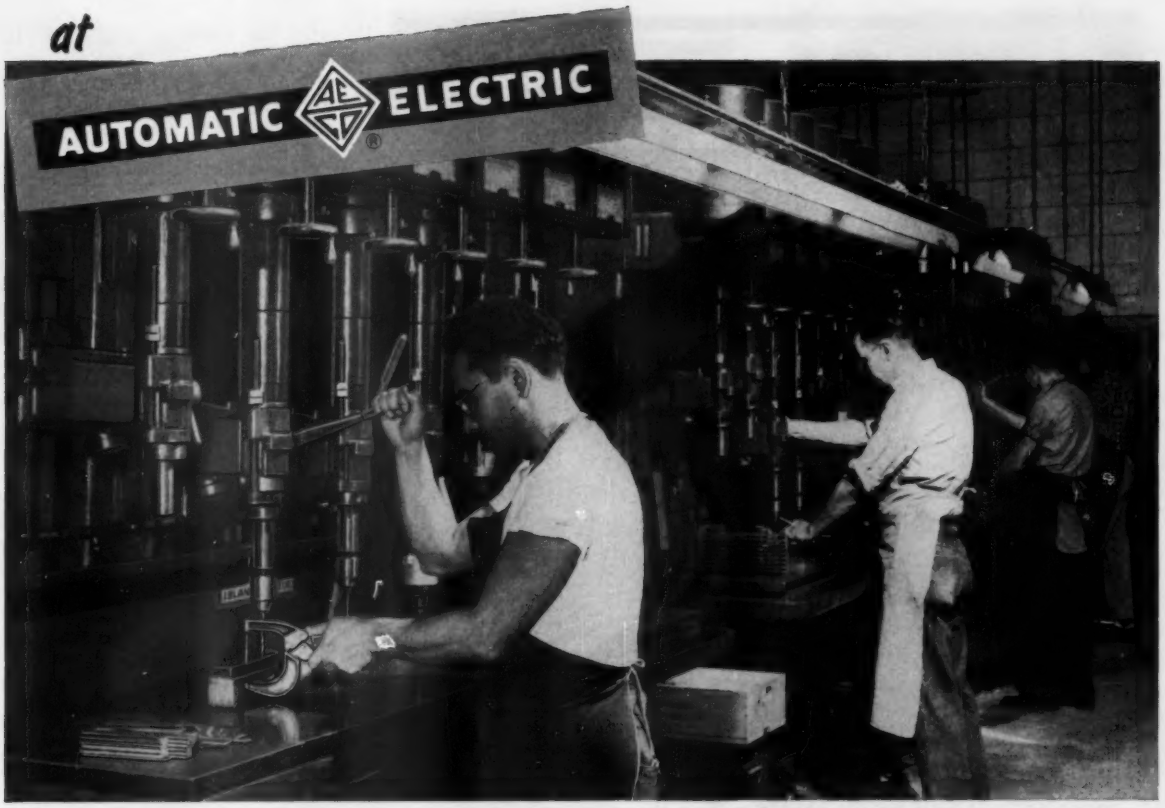
The fact that the surface roughness did not increase greatly was probably due to the fact that most commercial surface-finish instruments do not average the roughness over a long enough distance to take into account the height of the cusps produced when milling with a few teeth. In this case the revolution marks would be separated by .064 in. and the height of the cusp with a single tooth would be about 750 mu in. With two teeth the height of the cusp would be 200 mu in.; with four teeth it would be 45; and

SHOPMATES

N. Jarvis

"THIS IS THE PART PRINT "BUT WE THOUGHT YOU COULD MAKE THE MOLDS FROM IT" THERE "EA" AH" THERE'S NO TRICK TO IT" DO EVERYTHING BACKWARDS" THAT'S ALL"
MOLDS!! FROM A PART PRINT!!! F'CRYIN' OUT— AM I A MECHANICAL BRAIN EA SOMETHIN? IF YOU WANT A EINSTONE WHY'NT YA HIRE ONE??
THE ONLY TRICKY PART WILL BE TRYIN' TO ERASE THE MISTAKES OUT OF SOLID STEEL!!
THEY PICKED THE RIGHT MAN" HE JUST NATURALLY DOES EVERYTHING BACKWARDS ANYWAY"
N. JARVIS

at



This line of LELAND-GIFFORD *Drilling Machines is always busy*

At Automatic Electric Company, leading maker of telephone systems, relays and switch gear, precision drilling is a key production operation.

An infinite variety of large and small parts go into the equipment which they supply to telephone companies. Accuracy in drilling, tapping, reaming and related operations contributes to ease of assembly and faultless performance of equipment which is often complex, always vitally important to good telephone service.

To handle this wide range of drilling operations, and to provide the complete flexibility and fast speed changes necessary to expedite work flow, Automatic Electric Company relies on this battery of Leland-Gifford Multiple Spindle Drilling Machines. Particularly advantageous in handling work of this type are the centralized controls and built-in safeguards against costly errors featured on Leland-Gifford Drilling Machines.

The complete line of Leland-Gifford Drilling Machines offers a wide choice of machine sizes, number of spindles, swings and types of feed. They represent the ultimate development of more than 50 years of specialization in the manufacture of precision drilling equipment. Write for complete information or call the office near you.

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

CHICAGO 45
2515 West Peterson Ave.
DETROIT
10429 West McNichols Rd.
CLEVELAND 22
P.O. Box 853
NEW YORK OFFICE
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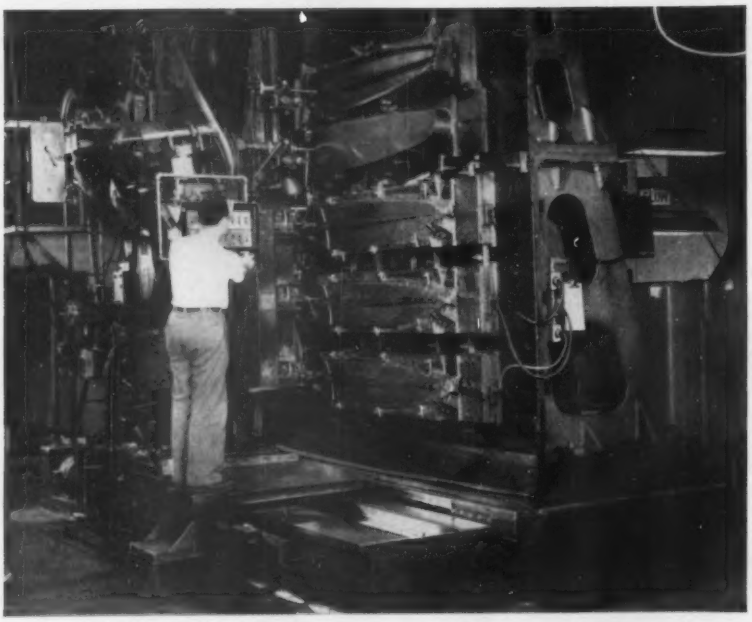
South Orange, N. J.
LOS ANGELES OFFICE
2620 Leonis Blvd.
Vernon 58, Cal.
INDIANAPOLIS 6, P. O. Box 1051
ROCHESTER 12, P. O. Box 24, Charlotte Station

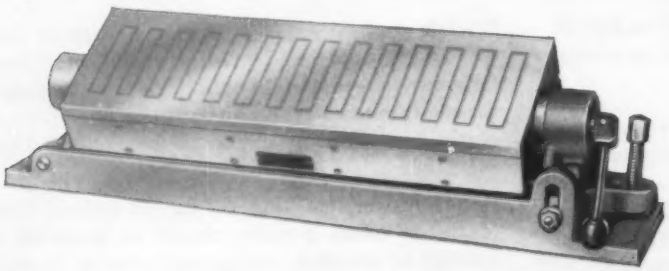
Walker Does it Again-



Three WALKER electro-magnetic chucks mounted on milling machine, making possible profile milling three propeller blades in one operation.

WALKER engineers and makes chucks for unusual applications as well as standard holding devices for irons and steels, non-ferrous metals and non-metallic materials.

Whatever your holding problem the originators of the magnetic chuck will solve it for you.



AND—A Walker Permanent Magnetic Swivel Chuck—a type heretofore limited to Electro Magnetic Chucks. Another one of many applications by Walker.

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

IN CANADA—UPTON BRADEEN & JAMES, LTD.

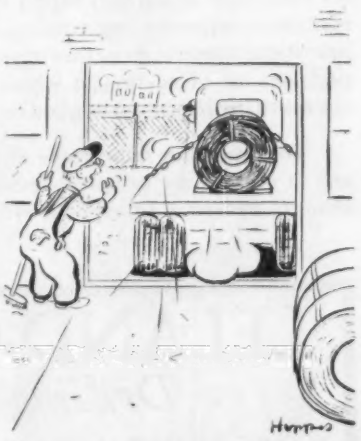
with six teeth it would be 15 mu in. Of course, these are theoretical figures and do not take into account the unavoidable run-out created in cutter sharpening and mounting.

The article did not point out that, as the feed is increased by a factor of 12, the cutting and normal forces would increase by a factor of 6 to 9, depending upon the exact operating conditions. This might well cause excessive deflection of both the workpiece and the cutter arbor to the extent that satisfactory work could not be produced in some instances. The increased forces would also require particular attention to fixture design to give adequate support to some workpieces. Apparently this difficulty was encountered in the tests, because the photographs show auxiliary clamping to prevent sliding of the machine vise on the milling machine table.

The absence of tool-life tests is unfortunate, as it is nearly always observed that there is a reduction in tool life as the feed per tooth is increased while all other operating conditions remain unchanged.

It must be noted further that standard milling cutters are designed for general-purpose application, and the number of teeth and helix angle are selected to give maximum utility to the greatest number of users. In fact, with slab milling cutters (plain milling cutters) of the type used by the authors, most manufacturers stock several designs for differing ap-

Helpful Henery



"Straight back—plenty of room, plenty of room!"

plications. In our product line the regular series cutters of three-in. dia have 16 teeth and an 18° helix angle. These are designed for moderate cuts. The heavy-duty series have 8 teeth and have a 45° helix angle. These are designed for heavier cuts. We also carry a series of helical plain milling cutters which, in the three-in. dia, have four teeth and a 52° helix angle. Other manufacturers carry a generally similar series of cutters. Of course, for special applications where standard cutters cannot be used, the design of cutters is varied to suit the operating conditions.

The selection of the best number of teeth in a milling cutter depends upon a number of factors of which the specific energy is probably one of the least important. A number of these factors are discussed in the July, 1955 issue of our technical publication "Metal Cuttings."

C J Oxford, Jr
Research Engineer
National Twist Drill & Tool Co.

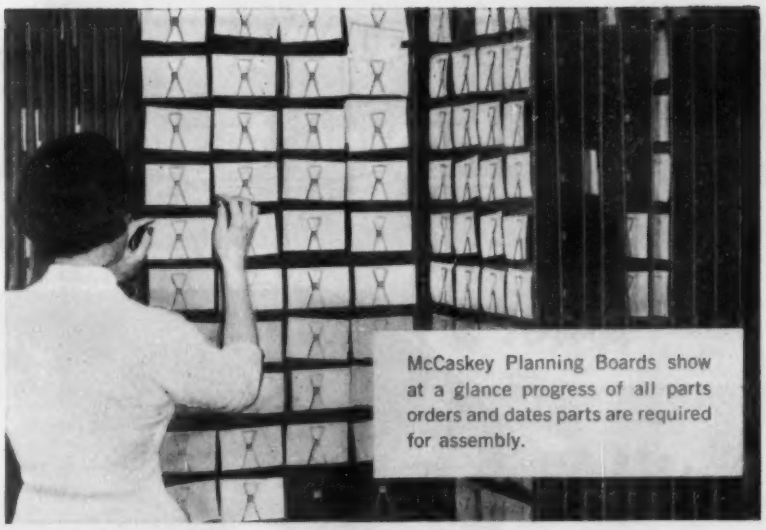
Difference of Opinion

In reference to my Practical Idea (*AM*—Aug 27 '56, p116), I note that a Mr Carl Johnson, Springfield, Ohio, suggests an improvement (*AM*—Nov 19 '56, p159). Owing to a misunderstanding, my idea stated that we have to hold close tolerances on the length of chamfer. I would like to point out that it is really the dimension L that is critical—that is, the dimension from the top end of the work to the start of the chamfer. The actual length of the chamfer is not important.

In Mr Johnson's idea, he is measuring from the small chamfered end and, in our work, this is not necessarily even a true surface, as it is not important to the dimension wanted. If the length of the chamfer were wanted, and assuming that the small end of the work is machined accurately, then the Johnson idea would provide a perfectly good solution; but in our case, the distance from the other end to the start of the chamfer is what counts.

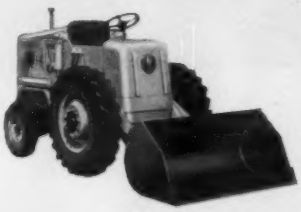
Charles Minaire
St Etienne, France

Readers Johnson and Minaire are both correct. Choice depends on existing conditions and the manner of stating the problem—Ed.

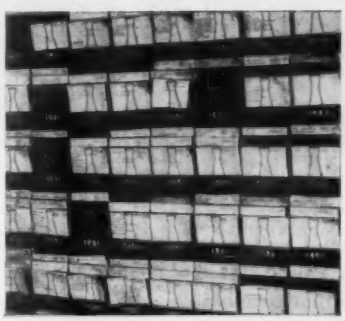


McCaskey Planning Boards show at a glance progress of all parts orders and dates parts are required for assembly.

McCaskey Scheduling and Production Control Pay Off For "Payloader"



Single form system saves costly man-hours and eliminates delays for The Frank G. Hough Co.



McCaskey machine loading and assignment boards schedule parts orders for machines and subassemblies.

McCaskey Planning Boards and Machine Control Boards—with *multiple copies of a single form*—prove effective for The Frank G. Hough Co. of Libertyville, Ill. during its present period of rapid expansion and increased employment.

Here are just a few of the ways McCaskey Scheduling and Production Control pay off for "Payloader"—how they can pay off for you:

(1.) Provide visible records of all jobs or parts orders and necessary completion dates.

(2.) Progress of parts orders is seen at a glance.

(3.) You can quickly review the status of every job in the plant and locate those that might upset schedule.

(4.) No delays because—Machine loading and scheduling of subassemblies proceed as specified by the production control department.

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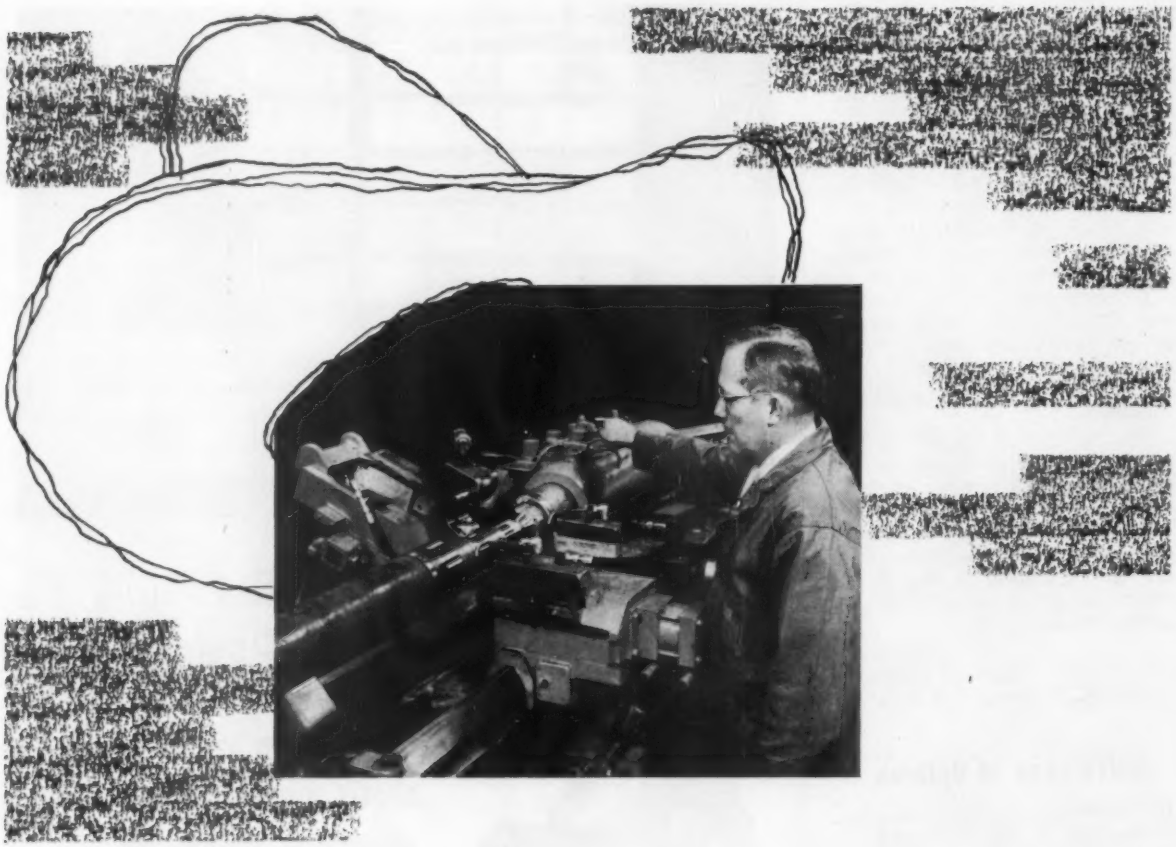
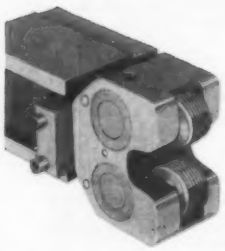


Roll your own *in no time* with a Monarch Mona-Matic!



ON THIS JOB, thread rollers mounted on the hydraulically-operated rear slide perform a very precise thread rolling job *during traverse return* of the front carriage. If that's not strictly "no time," it's certainly "no-cost time"—and who could possibly want more than that?

The part is a fabricated trailer axle, about 80″ long, identical spindle ends of which are turned and threaded. There are three turned sections on each end with the end diameter threaded at the tag end of the cycle.

Because the axle is fabricated by butt welding the forged, rough turned spindle ends to a piece of seamless steel tubing, an interesting front carriage cycle is employed. During one of the three feed movements, the welding bead is removed by a tool on a hydraulically operated auxiliary slide mounted on the left hand end of the carriage.

And that's only part of the Mona-Matic savings story! Customer used to turn on one machine, thread on another with a die head. Now he does the *whole job—on one machine—faster than just the turning used to take.*

Remember that thread rolling (up to 1½″ diameter) is an extra for some users—only one of many that can be yours when you turn the Mona-Matic way. Let us figure a job for you...**The Monarch Machine Tool Company, Sidney, Ohio.**

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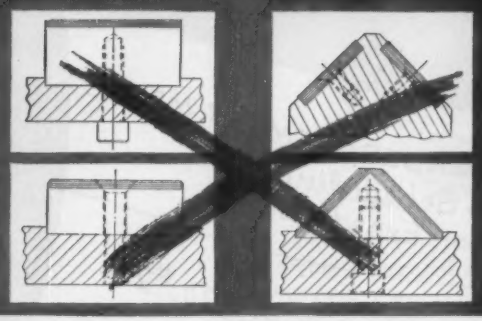
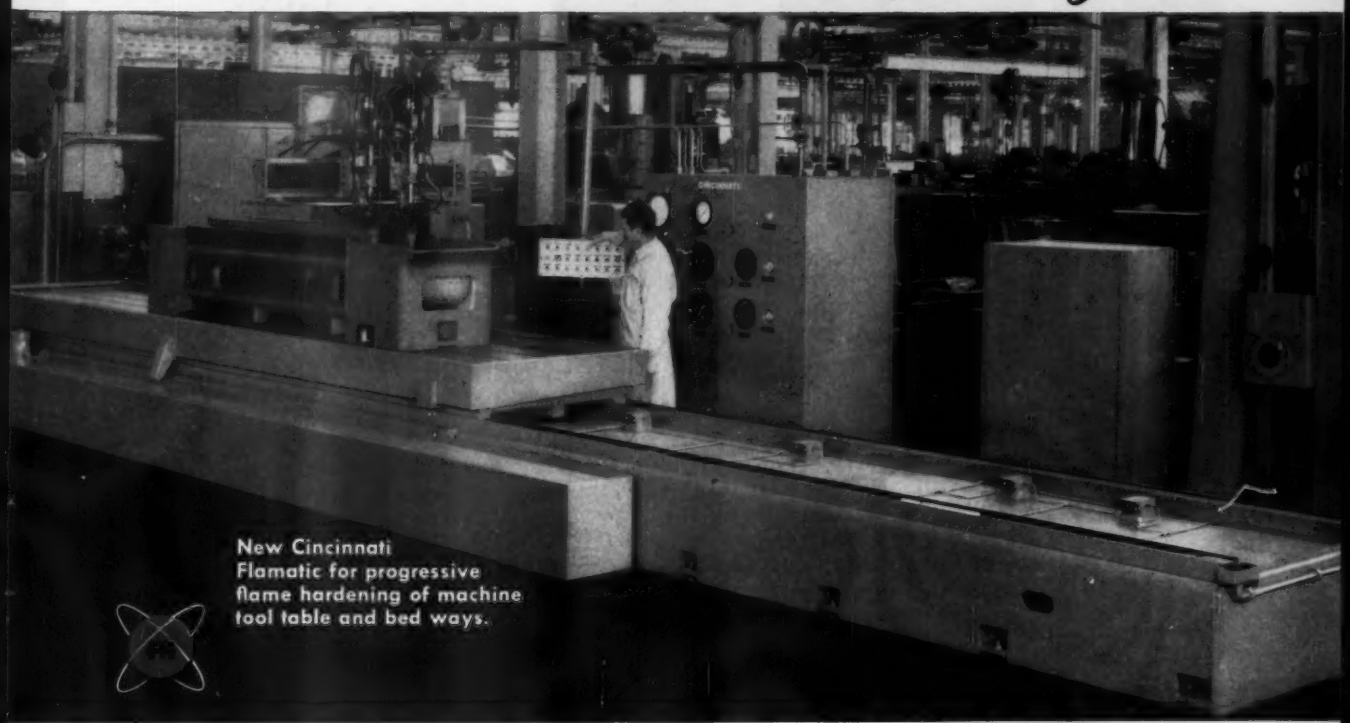


eliminate costly ways to get hardened ways...

use the flamatic *way!*



New Cincinnati Flamatic for progressive flame hardening of machine tool table and bed ways.

Cast iron machine tool table and bed ways are now being surface hardened on this new Cincinnati Flamatic®. Uniform hardness of Shore 75-80 is achieved. This Flamatic method results in substantial cost savings over methods currently employed of fastening hardened steel wear strips or sheets to cast or welded components in sliding contact.

The reciprocating work table of the Flamatic can accommodate castings up to 20 feet long x 44 inches wide x 40 inches high, on which integrally cast ways are to be hardened. Table feed is infinitely variable between 3″ and 15″ per min., and rapid traverse is at 25 ft. per min. Flame heads are mounted on a rail, powered for rapid positioning of the flame heads to the ways to be hardened. The flame head assembly includes water spray quench and a tracer mechanism, which at all times maintains the prescribed gap distance of the flame from the way . . . compensating for any distortion of the casting.

Oxy-acetelyne fuel gas is used; however, the unit will operate on propane or natural gas. Complete operating controls are located on a pendant station. Flame hardening of work such as columns, rolls, long bars and shafts, which can be held between centers on the table, is also accomplished.

Check into Flamatic surface hardening for savings in your production processes. Call in a Process Machinery Division field engineer.

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. . . because the new KING has *Full Electrical Operation* — with all controls conveniently located:

★ ***YOU CUT CONTROL MANIPULATION TO A BARE MINIMUM AND SPEED SET-UP TIME.***

. . . because the new KING is *Powered for Productivity* — 40 to 50 H.P. on 30", 36", and 46" sizes; 75 to 100 H.P. on sizes 56" and up:

★ ***YOU CAN OPERATE THE MOST ADVANCED MODERN CUTTING TOOLS TO THEIR FULLEST CAPABILITIES.***

. . . because the new KING has *Expanded Feed and Speed Ranges* — 24 pre-selective feeds from .0016 to .250 per revolution . . . 24 pre-selective speeds in any one of three standard ranges:

★ ***YOU GET REQUIRED FINISH AND SPECIFIED TOLERANCES ALL THROUGH THE SET-UP.***

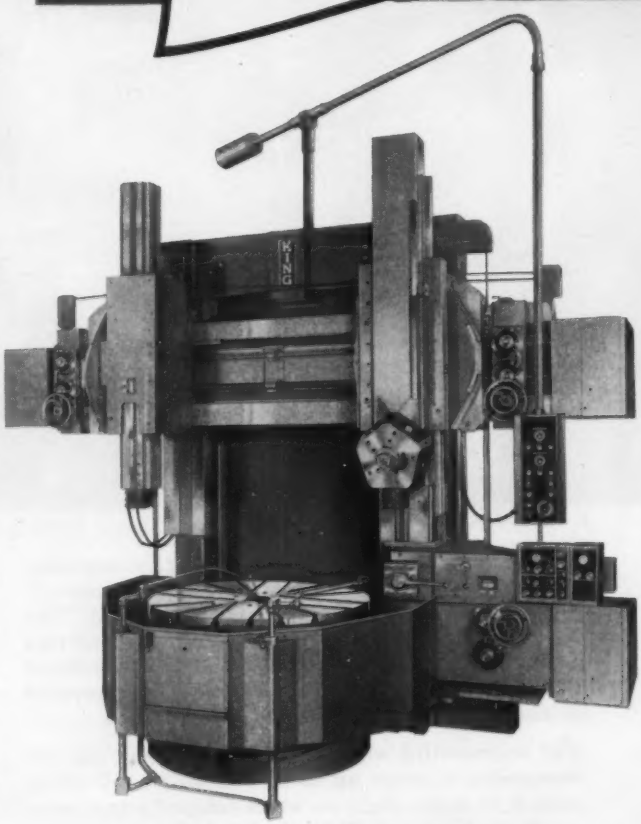
. . . because the new KING has an outstandingly improved spindle and spindle mounting:

★ ***YOU GET MAXIMUM TABLE STABILITY WITH RESULTANT INCREASED AND UNIFORMLY MAINTAINED ACCURACY.***

. . . because the new KING is readily adaptable for addition of Optional Features such as *Automatic Cycling, Automatic Positioning of Heads, Automatic Tracing Control of Heads, Power Rail Clamping,* etc.:

★ ***YOU HAVE BROADER TOOLING VERSATILITY FOR ATTAINING EXTRA-FAST AUTOMATED PRODUCTION AT MINIMUM COST.***

For complete details on the All-New KING Machines see the KING Distributor in your area or write us.



Machine illustrated is a 56" size with Ram Head and Turret Head on Rail, Side Head, and Coolant Pan. The New King Machines are available in sizes 30", 36", 46", 56" and up, in a wide variety of head combinations, with or without side head.

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KING Vertical Boring and Turning Machines

Spot news...

- **Most highly automated plant anywhere five years ago,** Ford's Engine Plant No. 1 in Cleveland, is being retooled and will be making newly designed V-8 engines within three months (capacity: 4400 a day). Three-fourths of its equipment is being moved out and the remaining fourth is being altered to fit new production lines. Engines for Mercury, Edsel, Lincoln and Continental will be built at Ford's new Lima, Ohio, plant. Ford's total outlay for expansion and tooling in 1957 will be $710 million.

- **Industrial applications take 80% of the 2½ tons of diamonds produced annually.** Man-made diamonds (about the size of a sugar grain) should increase the supply. Two-thirds of all diamonds for cutting and grinding are this size or smaller.

- **Curtiss-Wright may build a jet engine under license from Canada's A V Roe.** The engine, the "Iroquois," develops 20,000 lb thrust, much more than the most powerful US-built jet engine. This would mark the second such arrangement for C-W—several years back it produced J-65 engines under license from England's Bristol Aeroplane Co Ltd.

- **Metal products have had the biggest price rises of all finished durables** since mid-1955, New York University's Jules Bachman has told the President's Joint Committee on the Economic Report. While wholesale prices of finished durables rose 13%, metal products went up 14.9%, and machinery and motive products 12.9% (including 15% for electrical and 7.7% for farm machinery).

- **The atomic-powered automobile is an impossibility,** according to Chrysler's nuclear engineering chief, Clayton R Lewis, who claims an 80,000-lb atomic power plant is needed to propel a 3000-lb automobile down the street. Only possibility: indirect propulsion of cars from a central nuclear generating plant.

- **"Downtown" metalworking plants are feeling the pinch for skilled workers,** who are inclined to follow industries that are moving into suburbs and less-congested areas. The workers like the nicer working conditions, ease of parking, and the chance to own their homes in adjacent residential areas.

- **Heavy steel plate shortage can be alleviated** by correct use of alloy and clad steels, according to Lukens Steel's C L Huston, Jr, who says metal savings of 18 to 33 1/3% can be achieved by substituting lighter gages of high-strength alloys for heavier gages of alloy carbon steel.

- **India will switch from the inch system to the metric system** gradually over the next 10 years. Incidentally, India with West German help, for the first time will turn out modern milling machines (6 models) within a year from now.

- **High-strengh "42B" aluminum casting alloy is so much better** than existing alloys, according to its developer, North American Aviation, that castings made from it may replace many forgings in aircraft. Tensile strength is 42,000 psi when cast in a sand mold, 45,000 psi in a permanent mold. Other claims: good balance of yield and elongation, castability with ordinary foundry methods.

- **Air-conditioning boosts worker efficiency 20-30%** (for example) 76 days a year in Minneapolis, and 111 days a year in Kansas City, Mo, a GE study shows.

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Exactly the Power You Need

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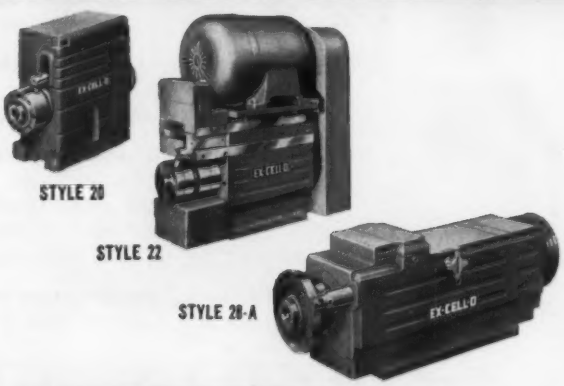
Ex-Cell-O Hydraulic Power Units come in sizes suitable for a wide range of applications. Compact design makes it possible to place them at close center distances either in line or radially around a fixture. No matter what the application, you get smooth, dependable operation.

Used in drilling, counterboring, spot-facing and reaming operations, these hydraulic power units can be designed into special-purpose machines with easily controlled automatic cycles. Units can later be re-arranged to perform different machining operations.

You can install these power units easily. They'll stand up under fast cycles and continuous operation; they're self-lubricated.

For complete information ask your Ex-Cell-O representative or write Ex-Cell-O in Detroit.



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56-45

Washington ... NEWS REPORT

Can we stem the price tide?

One of Washington's chief worries these days is rising prices. The government realizes that it alone cannot hold the rise in check—that it must have a lot of help from both industry and labor to keep prices and hourly wage rates from going up further.

On the firing line today is the supply-price ratio as it affects the new Highway Program, with a Senate Committee preparing to investigate. And if steel prices should rise again, antitrusters on Capitol Hill will put the steel industry on the griddle. And you can look for the oil people to get a going-over because of recent increases in price.

Tightening of credit as a means of braking or stopping the price uptrend is acknowledged to have had less effect than anticipated. Spotlighted by the President's Economic Report are: (1) the increase in capital outlays by business, (2) the rally in corporate profits after a third-quarter 1956 rally, (3) expansion in payrolls and unemployment, (4) growth in foreign investments, (5) a gain in local and federal government spending, and (6) a rise in retail sales.

Business and financial institutions, on the other hand, are less liquid because credit demand far exceeds the supply. And housing, too, is in a decline because of tight money. Another dark spot in the economy: household appliance makers are cutting production.

Taft-Hartley rulings . . .

The Supreme Court has come up with some new rulings on the Taft-Hartley Act that give a union more freedom to strike at wage-reopening time midway through a long-term contract. By its new rulings, the Supreme Court throws out a lower court ruling to the effect that such strikes are barred until "the end of a 60 day notice, or expiration of a contract, whichever is later."

Such a provision, if taken literally, would conflict with the overall purpose of Taft-Hartley, "To substitute collective bargaining for economic warfare, and to protect the right of employees to engage in concerted activities for their own benefit," the Supreme Court has ruled.

No World War II tax refunds . . .

Any hope on the part of defense producers that they might get millions of dollars in tax rebates, based on claims that the partial accelerated tax amortization program of WWII was illegal—has been killed by the Supreme Court.

Supreme Court has unanimously upheld the partial tax writeoff policy, rejecting claims by more than 40 firms to the effect that the law entitled them to write off 100% of the cost of WWII-built defense facilities.

Hikes in military hardware buying . . .

It's becoming clear that spending for military hard goods during the next three years will be higher than the administration has been willing to say in the past. Defense Secretary Wilson estimates a hike of at least $1 billion in fiscal 1959—over and above the $2 billion increase in fiscal 1958. Almost all of this is earmarked for major procurement. Meantime, Pentagon budget officials now doubt that spending can be kept down to the $38 billion expenditure level outlined in the fiscal 1958 budget. Here too, the extra sums involve planes, missiles, and other new weapons in production or in the latter stages of development.

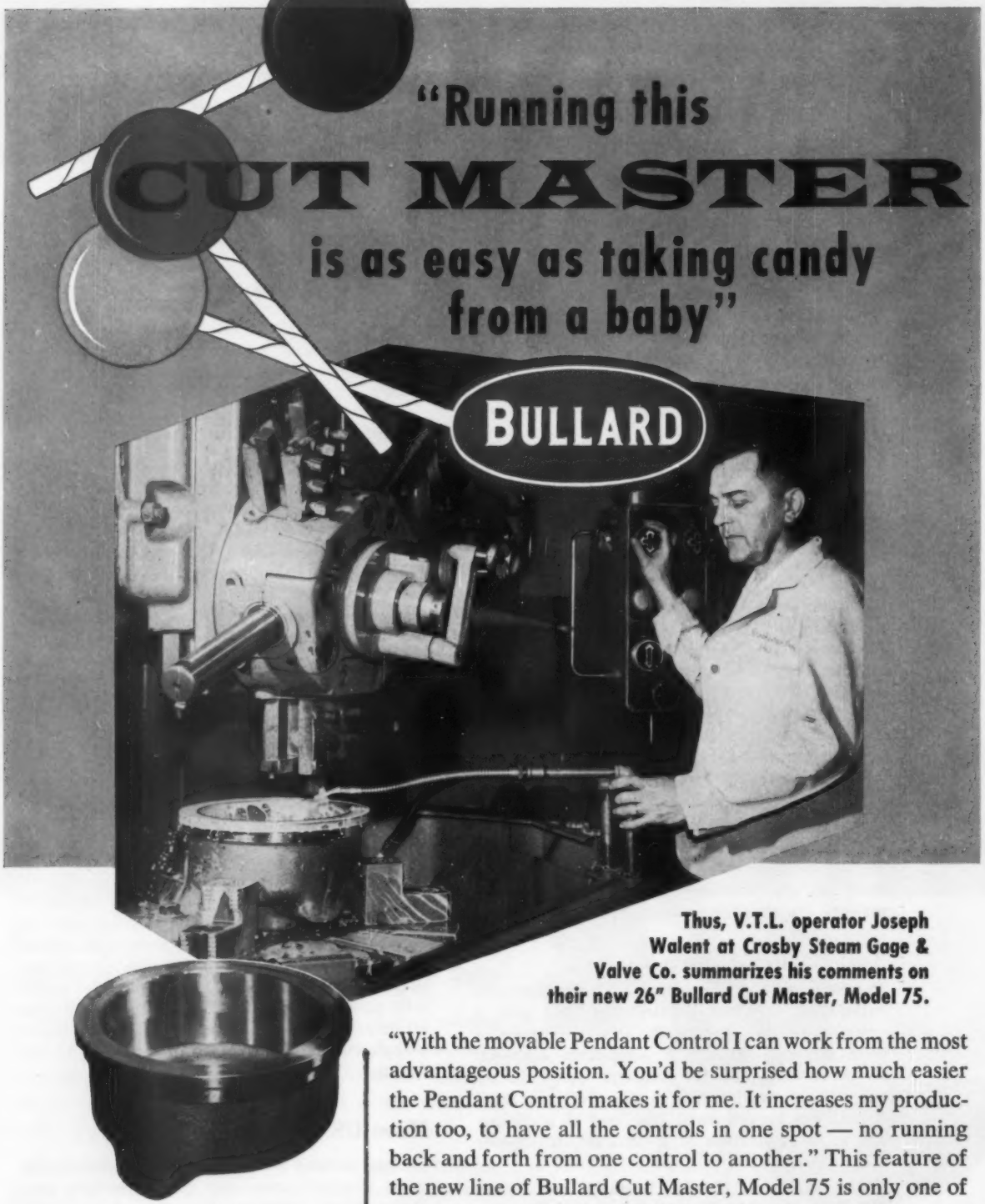
Top priority for missiles . . .

New BDSA regulations require metalworking companies and other suppliers to give top priority to orders for components and other materials used in the military ICBM-IRBM program. Up to now, ballistic missiles rated on a par with aircraft, atomic weapons, and all other defense goods. Under the new rules, ICBM-IRBM contracts and purchase orders will carry "DX-ratings"—taking priority over all other orders and requiring suppliers to report acceptance or rejection of the orders to the Defense Dept within five days.

More US missiles for Britain . . .

US has worked out a deal with Great Britain tying the two countries' guided missile programs close together. At press time, exact details on the deal were still secret. But the aim is to help the British ease their dire economic position by allowing them to cut back heavy defense costs. Major provision will be to supply Britain with US Air Defense missiles —like Nike Ajax. Britain, in turn will reduce the size of its fighter-interceptor air defense force, coordinate its missile development programs more closely with US projects.

"Running this CUT MASTER is as easy as taking candy from a baby"



Thus, V.T.L. operator Joseph Walent at Crosby Steam Gage & Valve Co. summarizes his comments on their new 26" Bullard Cut Master, Model 75.

"With the movable Pendant Control I can work from the most advantageous position. You'd be surprised how much easier the Pendant Control makes it for me. It increases my production too, to have all the controls in one spot — no running back and forth from one control to another." This feature of the new line of Bullard Cut Master, Model 75 is only one of many reasons why you should have them in your plant.

Why not get the full story — ask for a catalog by calling your nearest Bullard Sales Office, Distributor or write

THE BULLARD COMPANY
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Detroit ... NEWS REPORT

No expansion cutback for GM . . .

"Does this herald the end of the expansion boom?" Detroiters wondered when General Motors announced it would delay construction of two giant assembly plants at Sunnyvale, Calif, and Lordstown, Ohio.

GM has answered the question—and the answer is "no." The same "no cutbacks" statement has been made by both Ford and Chrysler, both of which have extensive programs in the works. American Motors and Studebaker-Packard haven't officially announced any expansion programs, but optimism is high in both companies.

But if GM isn't cutting down on its capital spending, why are the two plants pigeonholed?

Sunnyvale was scheduled to produce the Buick-Olds-Pontiac line at an annual output rate of 100,000 units. The plant wouldn't have been ready before late 1958 or early 1959.

Trouble with setting up the Sunnyvale plant lies in the cloudiness of GM's crystal ball. General Motors at the moment very definitely hasn't decided what type of body structure the B-O-P models will have in 1960—whether it will be an "X" chassis with outriggers like that of the 1957 Cadillac, or a form of unitized body construction (although recent GM thinking is getting away from the unitized body principle). Thus the extremely long-range planning involved in the Sunnyvale plant has piled up enough bugs to delay its construction.

The problem is different at Lordstown, where the "go ahead" has been delayed once before. Some GM officials aren't convinced that the Lordstown site is either necessary or correct. The plant is scheduled to assemble Chevrolets —and Chevvy is having a stiff battle with Ford to hold its king-size share of the market.

Thus indecision over Lordstown could well spring from two factors: (1) the uncertainty of the wisdom of the location, and (2) the certainty that Chevvy will have to be changed radically in 1958—and possibly again in 1960 or 1961—to meet stiffening competition.

GM won't say how much it meant to spend on new production machinery, tools and fixtures for the two plants, but it's a pretty safe guess that at least $40 to $50 million worth of machinery won't be purchased this year because of the decision to delay Sunnyvale and Lordstown.

And, giving further lie to rumors that GM is cutting its capital spending budget, Harlow Curtice says General Motors will make large outlays for 1957, with tooling and facilities running to $1.25 billion. Of this sum, about $550 million will go for tooling and machinery.

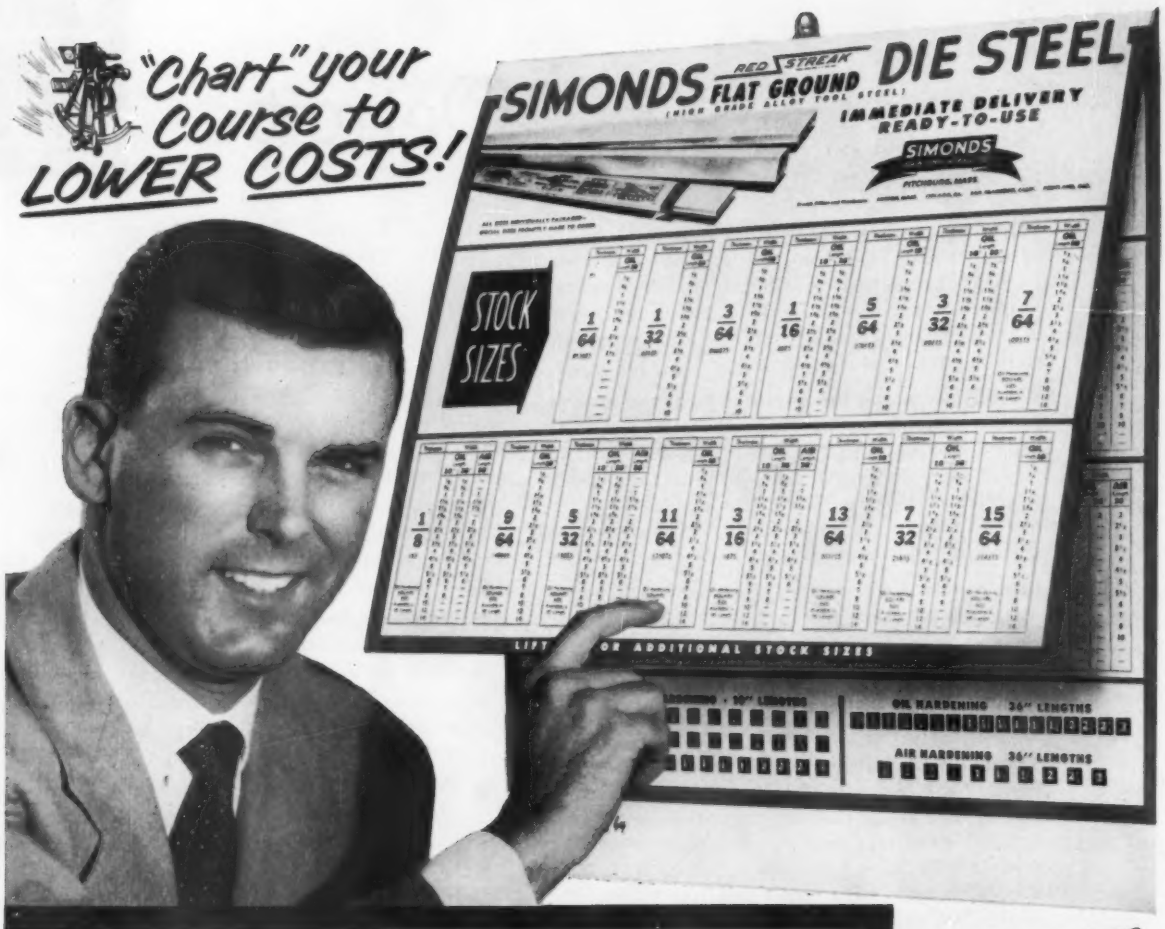
Sales and production . . .

Sales began to firm up in mid-January—traditionally the season's "slow" month—and it looks like it may have been the second best January on record, trailing only January 1955.

- **Plymouth is working six days a week,** and has scheduled substantial increases in output of hardtops, station wagons and convertibles, cutting back on sedan output.
- **Chrysler's Imperial sales** are limited only by production facilities, with the whole Chrysler Division on a six-day week.
- **Ford has stepped up Saturday programming.** Mercury is working six days a week. So is Lincoln, but Continental output is 'way off.
- **Chevrolet has upped production by 3 to 4%,** but is still behind last year's output.
- **Pontiac is running steadily** at a 9000-plus per week rate. Olds assembled less cars this January then it did in the two previous Januarys.
- **Buick has slowed somewhat,** with about 33% of its output devoted to the high-priced Roadmaster and Super models. Cadillac is currently running ahead of 1955 schedules.

Things to come . . .

- At least two Ford products will have air suspension this year—possibly three. The '58 Lincoln and the '58 Thunderbird are sure bets, with the "Super-Mercury" a possibility.
- Nash and Hudson may go to air suspension as a running change about May or June.
- Ford's Thunderbird will undergo considerable body restyling, and there's talk of a five-passenger "T Bird" for the sporting family trade.
- Look for the Continental Mark II to rejoin the Lincoln nameplate as an ultra-fine Lincoln—with four doors instead of two.
- American Motors may run in the red again this quarter because of strikes. Last quarter's Dale Industries strike (Dale supplies bumpers to AMC) put AMC on the debit side of the ledger. This time, AMC bought labor peace in its own plant by a quick agreement to pay "without prejudice" all union grievances over the two-day turnaround. But loss of even one day's output hurts struggling AMC's pocketbook plenty these days.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Machine tools ... NEWS REPORT

Builders show confidence . . .

Though incoming machine tool orders for the industry may fall short in 1957 of last year's figure, no major decline looms.

Managements of machine tool companies view the future with far more confidence than published reports would lead one to believe.

A spot check among builders reveals this:

Builder A—January sales were seasonally slow, but at good rate for this time of year. Sales in 1957 should be as good as 1956 despite pessimistic forecasters. Backlog is nine months and shop is working two 54-hr shifts. Scarcity of skilled help still is major problem. Major factor in 1957 is high demand from abroad, with export sales up about 17% over 1956.

Builder B—Optimistic that sales this year will equal 1956 total. Orders off since first of year because of seasonal delays in converting appropriations into buying orders. Inquiries at very high level. Shop working two shifts and expects to add 135 men to production force in spring.

Builder C—Sales have improved recently and are running 15% ahead of year ago. Outlook is good, with prospects for bigger sales volume in 1957 than in 1956. Demand for standard machines has improved materially in recent months. Shortage of skilled help is major headache.

Co. D—Sales in December and January off more than seasonally but sure that some of drop is due to long delivery promises. Total sales may be down some from 1956, but not much.

Co. E—Highly optimistic about outlook for 1957 sales. Orders now coming in are scattered throughout heavy industry. Some indication that large companies are slowing down purchases because they want to review programs and make sure they are on right track.

Co. F—Inquiries continue at high level. Sales holding up well for both special and standard machines. Year should be as good as '56

Co. G—New orders this year should be in about same volume as last year (this company makes only standard machines). Backlog is 5-6 months and operations are at capacity. Volume of inquiries about same as year ago (very big).

Co. I—New orders are just about matching production. Business is coming from all over. Shortage of engineers is being felt. Foreign shipments are at high rate (20%).

Co. J—Has turned down number of orders for special machines because does not have productive capacity or engineering staff to handle them. Outlook bright.

Some builders highly dependent upon the auto industry for a large portion of their business have had a drop in demand far beyond that in the machine tool industry as a whole.

Tight money is headache . . .

Tightness of money is having an adverse effect on orders, but not to the extent that publicity on the subject might lead one to believe.

At least a few builders are seeking to ship completed machines ahead of schedule to collect cash to augment their working capital, a prominent distributor reports.

Another distributor states that he has been active in securing financing for several large deals or he would not have got the orders. Still another distributor says that financing is his biggest problem, with requests snowballing for time payments.

Some major replacement and expansion programs are likely to be postponed until money is easier to get at reasonable interest rates, one distributor declares.

What about defense tool programs?

Whether the armed services will get around to spending any money in calendar 1957 for replacement of machine tools, under the Defense Department directive of September 21, 1956, is a moot question in Washington. All three services say that they will. But some observers have grave doubts.

Each service, under the directive, is to put into its fiscal 1958 budget (year beginning next July 1) a request for 2% to 5% of the acquisition cost of its machine tools for replacement of tools currently in use.

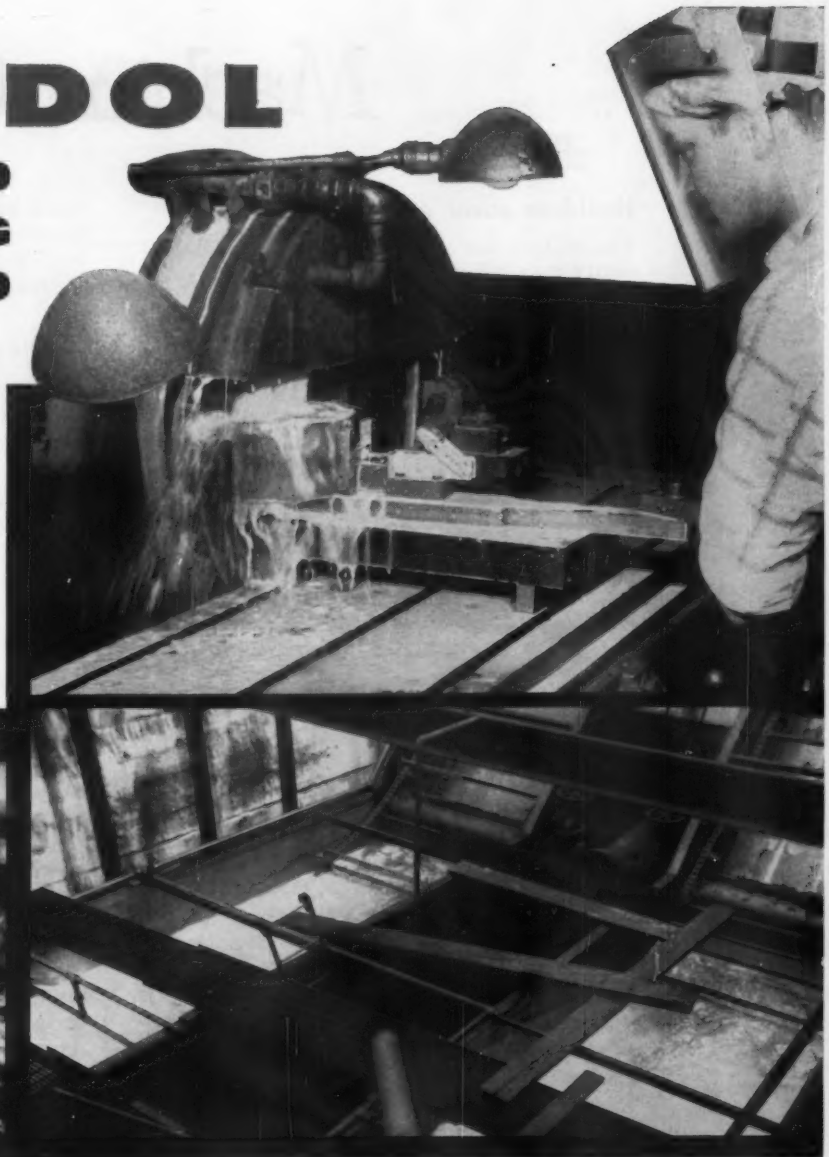
The maximum expenditure by all three services would be $150 million, this amount being equal to 5% of $3 billion, which is reported to be the cost of tool holdings of the services.

Each service has come up with its own replacement formula. The Navy has devised a replacement analysis stemming from and closely resembling the MAPI formula. The Air Force has one that is said to use the double-declining-balance method of depreciating the cost of equipment. The Army, on the other hand, clings to straight-line writeoffs in its formula.

BF

Stuart CODOL

LIQUID GRINDING COMPOUND



Disc grinder (right) hogs off approximately .035 in. from rough Alnico castings. Small segmented bar-type magnets are ground at a high rate of production on an automatic double-spindle disc grinder. Stuart's Codol helps maintain profitable production . . . covers machine ways and moving parts with a rust-inhibiting film of light petroleum oil.

Continuous grinding is more efficient with Codol as it resists overheating, minimizes wheel loading . . . reduces downtime for sharpening the wheel.

Codol's stability prolongs its effectiveness, reducing cutting oil costs. More than 15,000 gallons of a 3.5 per cent Codol and water solution are circulated from this outdoor reservoir to a battery of grinders in the Spaulding Works of Crucible Steel Company.

How you can use Stuart's CODOL to step up production and reduce costs!

Take advantage of today's improved wheel bonds and more powerful grinding machines by using Stuart's Codol Liquid Grinding Compound . . . a carefully formulated combination of petroleum oil and emulsifier. To give you maximum on-the-job economy, Codol permits faster stock removal, using heavier feeds and harder, larger wheels. For Codol *lubricates* as it cools, prevents metal flow and wheel loading, and eliminates stress failure from heat generated by grinding. On precision work, Codol guards against heat distortion and assures maximum dimensional control . . . especially important when grinding thin-walled parts. Break the heat barrier and upgrade performance on your cylindrical, centerless, and surface grinding operations with Stuart's Codol!

"Rust problems eliminated with Stuart Codol," that's the report from the Spaulding Works of Crucible Steel Company, Harrison, N. J.—makers of widely used Alnico magnets. Experience there on several different grinding machines has proved that Codol's high detergency, lubricity, cooling, and rust-inhibiting characteristics save money by reducing machine wear . . . prolonging wheel life . . . providing good stock removal conditions for rough- and finish-grinding operations.

Since these grinders are serviced from a central reservoir, a highly developed water-mix compound is important for over-all production efficiency at Crucible.

Codol's carefully balanced surface tension floats chips away from the wheel, work, and machine . . . provides a protective film of lubricating oil for machine ways, guide bars, and moving parts . . . gives two-way cooling action that assures efficient grinding at high production rates.

Crucible Steel Co. eliminates rust, reduces machine wear, grinding with Stuart's Codol!

Codol keeps wheel free-cutting on this high-production, single-pass grinding operation, with .0025 in. downfeed per revolution.

Template checks accuracy of convex poles after grinding ends of rough Alnico castings. Codol keeps wheels sharp and free-cutting when "hogging off" stock on the disc grinder.

Phone your
Stuart Service Center

Arrange now to test Stuart's Codol on your difficult grinding jobs.

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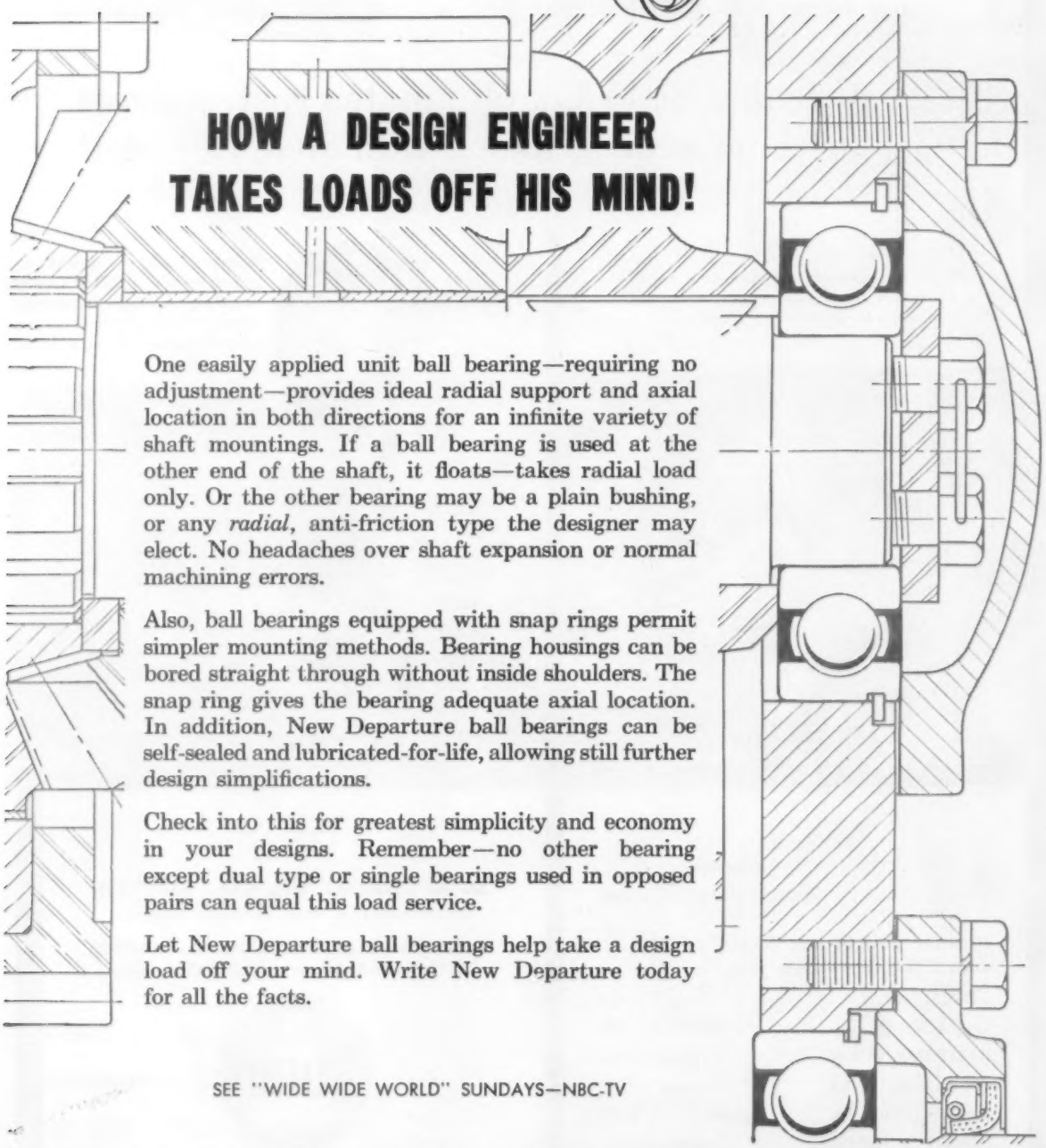
METALWORKING LUBRICANTS

FACTS

about

NEW DEPARTURE BALL BEARINGS



HOW A DESIGN ENGINEER TAKES LOADS OFF HIS MIND!

One easily applied unit ball bearing—requiring no adjustment—provides ideal radial support and axial location in both directions for an infinite variety of shaft mountings. If a ball bearing is used at the other end of the shaft, it floats—takes radial load only. Or the other bearing may be a plain bushing, or any *radial*, anti-friction type the designer may elect. No headaches over shaft expansion or normal machining errors.

Also, ball bearings equipped with snap rings permit simpler mounting methods. Bearing housings can be bored straight through without inside shoulders. The snap ring gives the bearing adequate axial location. In addition, New Departure ball bearings can be self-sealed and lubricated-for-life, allowing still further design simplifications.

Check into this for greatest simplicity and economy in your designs. Remember—no other bearing except dual type or single bearings used in opposed pairs can equal this load service.

Let New Departure ball bearings help take a design load off your mind. Write New Departure today for all the facts.

SEE "WIDE WIDE WORLD" SUNDAYS—NBC-TV

BALL BEARINGS MAKE GOOD PRODUCTS BETTER

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

What's ahead ... in Metalworking

NEWS REPORT

Pileup of orders assures high operating rate . . .

The working off of huge backlogs of orders for capital goods of all kinds is still the main support for a metalworking production rate never before attained in peacetime.

The pileup of business is so big that present operations should hold through the first quarter and perhaps clear up to midyear.

Industrial machinery, heavy electrical equipment and a host of industrial products are being turned out by factories working double shifts, mostly on an overtime basis.

The farm implement industry is another metalworking sector which is showing strength. Output is looking up, but the gains are modest at best. It is a turn-around, however, from the downtrend that continued over many months.

Boom times in aviation . . .

Aviation is in the midst of a peacetime boom. Almost all plane parts makers have tremendous backlogs that will keep them busy for months.

In addition to the large backup of orders for jet planes in the industry, 16 prime contractors are at work on the Air Force's program for long and medium range ballistic missiles.

Guided missile programs are mushrooming, with all three services making sizable awards.

Auto parts outlook is in sharp contrast with what's ahead in plane production. Some auto parts people are revising their estimates downward and are talking in terms of a six-million-car year. Ford and Plymouth suppliers appear to be especially happy.

Manufacturers of metal products for home building and the home are a little nervous about the dip in home construction. Up to now however they have done pretty well.

Gray iron foundries guess that their production this year will surpass the 14.2 million tons turned out in 1956. They may well set a new record (previous high mark was 1951—14.9 million tons).

Some foundries have raised prices 4% to 8%. All are likely to take such action before the end of the current quarter.

Buyer's market in sheet and strip . . .

Pipe, plate and structurals now are the only scarce steel items. Cold-rolled sheets are in the most liberal supply in a long time. In fact, sheet and strip mills are looking for business, with a buyer's market prevailing.

Some steel makers are turning ingots into semi-finished mill products and storing them, an action they have not taken for 2-3 years.

Big steel customers, such as the auto and home appliance people, are buying pretty much on a week-to-week basis, with pin-pointed delivery dates specified to the mills.

Steel warehouses are doing a normal business. Their main embarrassment comes from mills offering more tonnage than they can comfortably take.

Steel fabricators of products going into new houses are feeling the slack in orders, as home building sags.

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AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

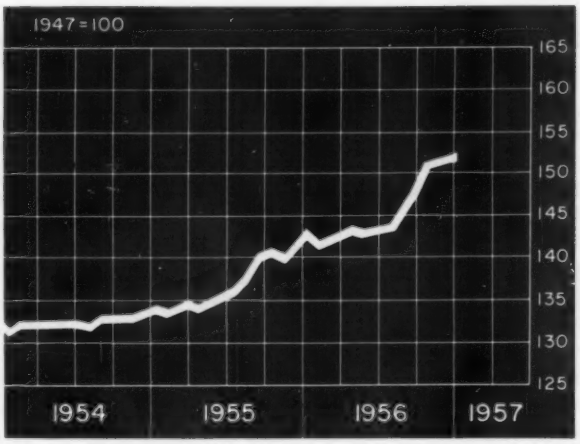
	JAN. Estimated	DEC. Preliminary	NOV. Revised	DEC. Year Ago
Total Index	**181**	**181**	**180**	**172**
Machinery	**154**		**155**	**143**
Electrical Machinery	**217**		**219**	**198**
Autos	**152**		**151**	**167**
Other Transportation	**336**		**330**	**294**
Other Metalworking	**144**		**144**	**142**

NEWS REPORT What's ahead . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JAN. Estimated	DEC. Preliminary	NOV. Revised	DEC. Year Ago
Total Index	**152.0**	**150.9**	**150.8**	**141.3**
Metalworking Machinery	**174.3**	**174.1**		**158.6**
Other Machinery exc. Electrical	**158.8**	**158.5**		**148.0**
Electrical Machinery	**151.3**	**151.2**		**137.5**
Fabricated Metal Products	**143.4**	**143.3**		**136.0**

152



Service industries are growing: so are their costs . .

Mushroom growth of service industries has outstripped that of manufacturing—to the point where more people are producing services than goods.

Some startling economic facts lie behind this: (1) consumers spend three times as much for services as they spend on all durable goods put together—and that includes automobiles, and (2) more than half the US labor force earns its living by providing services or by distributing and transporting goods. By contrast only one out of four workers is employed in a factory.

And the service industries will probably continue to grow faster than manufacturing. One reason for this is that with today's machines and techniques industry can turn out more goods with the same number of workers. This has released labor to the service industries, which have shown a negligible increase in man-hour productivity.

New products—television for example—are creating thousands of servicing jobs. Today, the public can afford more services than ever before and because of shorter workweeks has more leisure time to give to them.

But costs of services—both needed ones and those concerned with the frills of life—have gone up fast in the last few years. Since 1948, service costs have jumped 35%, contrasted with a 10% increase in the prices of goods.

One reason for such big cost hikes is a low increase in productivity—barbers' methods have changed little in 20 years, buses and trains carry about the same number of people. And as wage rates have climbed, prices have gone right along with them because the higher costs could not be absorbed by productivity increases.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	152.9	152.9	150.7
Steel ingot production (thousand tons)	2,485	2,472	2,444
Electric power output (million Kilowatt hours)	12,410	12,556	11,512
Production of automobiles and trucks	179,306	177,778	169,263
Engineering construction awards (Eng. News-Record, millions)	$406.8	$222.1	$533.0

MONTHLY BUSINESS INDICATORS

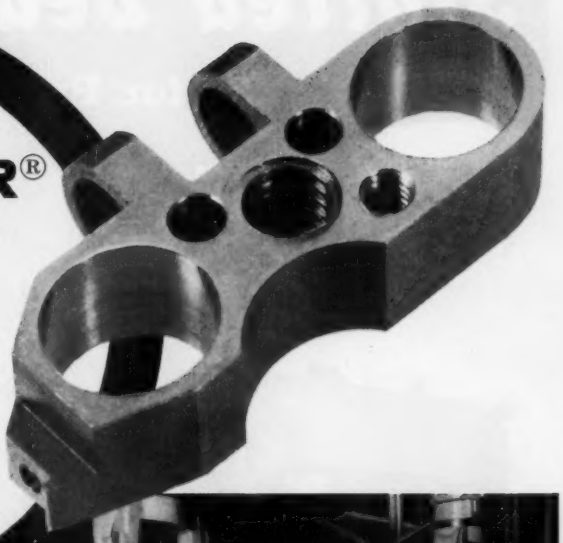
	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	201	262	236
Vacuum cleaners sales (thousands of units)	372	320	351
Washers sales (thousands of units)	449	403	362
Household electric ranges sales (thousands of units)	76	82	104
Radio production (thousands of units)	1,349	1,319	1,500
Television production (thousands of units)	821	894	760
Gear sales index (1947-49=100)	216.2	299.8	210.4
Foundry equipment new orders index (shipments, 1947-49=100)	121.0	122.2	154.4

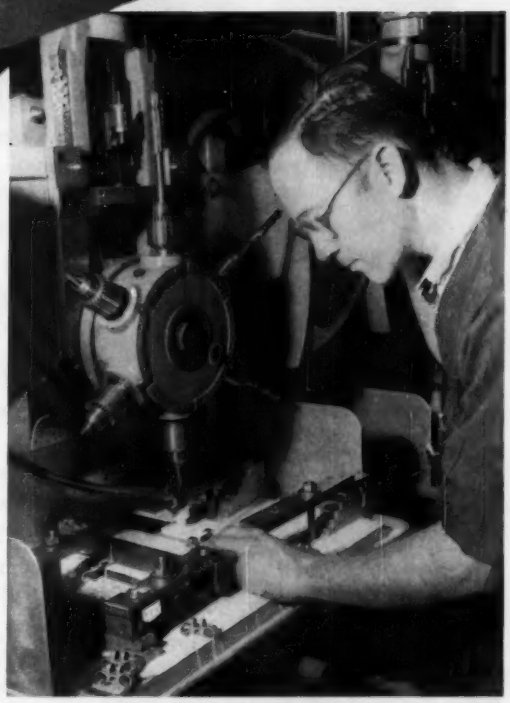
* Seasonally adjusted

BURGMASTER®
TURRET DRILLS

save space,
increase production,
hold close tolerances at

THE GARRETT CORPORATION'S
AiResearch Manufacturing Division





The part in the particular operation shown is a carriage used in a pressure-ratio transducer. Tolerance specifications require that all bores be within .0005 of centerline of each other.

Here's what the company has to say:

"Use of the Burgmaster Model 1C turret drill has been a valuable item in space conservation.

Four Burgmaster drills, each carrying six spindles, take up about 15 feet of space at AiResearch, while next to them a line of 20 single-spindle machines occupies three times the space.

The Burgmaster contributes to increased production and more proficient operation by operators, since it permits them to perform in one place a job requiring various types of spindles, which would otherwise necessitate moving back and forth on a line of conventional spindles. It allows use of a stationary jig for operations of various depths and sizes.

Tolerances within .0005 and less can be consistently maintained by the Burgmaster 1C on ream and bore diameters, with .0003 to .0005 on hole locations in jig work."

The Burgmaster 1C 6-spindle turret drill is a sensitive feed, fast operating machine. It features such important benefits as power indexing, preselective speeds and stops, time savings and increased accuracy by elimination of quick change tools. It easily handles holes up to ⅜" in steel. Larger capacity Burgmasters, both manual and automatic hydraulic are available.

For complete information, write Dept. AM-2

BURG TOOL
Manufacturing Company, Inc.
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RIDGEWOOD, N. J. • CHICAGO • CLEVELAND
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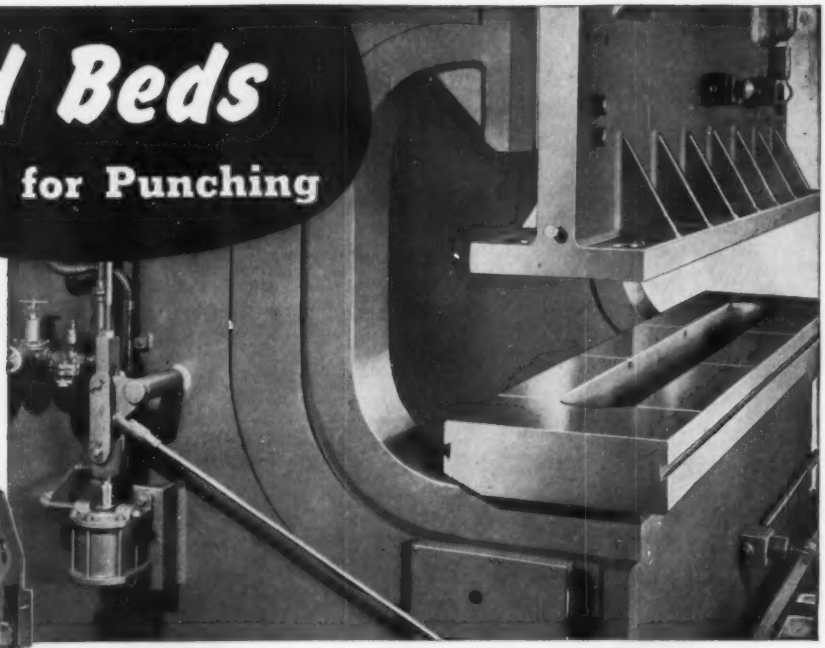
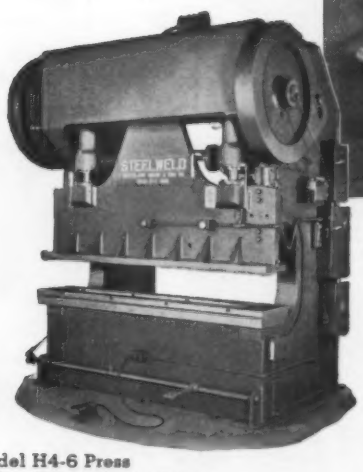
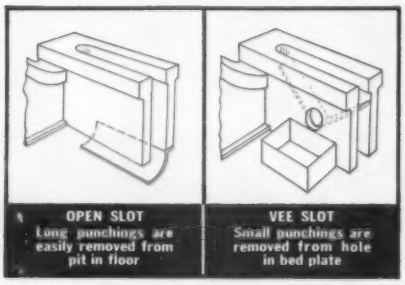
Slotted Beds for Punching





Model H4-6 Press with slotted bed. Handles plate to 6' 0" long between end housings. Operated by foot treadle or air-electric control.


OPEN SLOT
Long punchings are easily removed from pit in floor
VEE SLOT
Small punchings are removed from hole in bed plate

Converts Bending Press to Punch Press... and Cuts Costs as Much as 1/2

Because Steelweld Presses adapted for punching often cost as little as one-half that of ordinary punch presses a number of companies have purchased them and effected real savings.

Double-plate beds are usually employed with extra wide bed and ram to support the dies. In other respects the presses are standard. Machines have been built with beds as wide as 36", with slots in bed varying from 3" to 6¾" wide. The punchings drop between the bed plates (See sketches) and are easily removed from behind the machine.

The same presses used for punching can be used for bending and other forming operations. Steelweld Presses are standardized in all lengths to 20'-0" and in various capacities to 750 tons. Larger sizes and capacities on request.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

Once Again, Selling Is Our No. 1 Job

Business in Metalworking has been pretty slick for quite a while. Manufacturers have worried more about getting out the orders than about order-getting.

It would be nice for everybody if that happy state went on forever. But it is too much to expect. We should live so long!

The truth is that managements are rapidly facing up to the fact that the record-breaking production volume now prevailing is outrunning sales. Backlogs are getting thinner rather than fatter.

With this reversal of things, it is natural that buyers should become more demanding. They are not so ready to place orders freely and handsomely. They feel that once again they are back in the driver's seat. They are a little more hard-boiled than they were.

What they are saying is . . .

something like this: "Sure we've got money to spend. But we are spending it more carefully. We are interested in any proposition that will help us make a better and more acceptable product cheaper. But you had better have all the facts, or thumbs down."

The meaning of all this to Metalworking management is obvious. From now on, your participation in the nation's prosperity is going to depend upon your ability not only to produce a good product, but also to sell. For, once again, the spotlight is on selling.

It is a good time to examine closely your sales organization, whether you sell direct or through distributors. Are you adequately prepared to meet head-on the fierce competition for business?

How much do the men who sell your product know about it? Do they know what it will do for customers? How familiar are your sales representatives with the problems of your customers and what can they do to help solve them?

Do you know how big . . .

your market really is? Are your salesmen doing a thorough job of covering that market or are they satisfied merely to deal with the big customers?

Are your salesmen doing a hard-hitting selling job, or do they tend to make just social visits? If you sell through distributors, how often do you bring them and their sales force into your headquarters for a thorough briefing on what's new? If you sell direct, how recently have your salesmen been in for a refresher course?

Metalworking operations have never been higher than now, except in wartime. Despite a dip in new orders, nothing on the horizon is indicative of a sharp slump. The year as a whole may well surpass 1956 in total production.

There is lots of business . . .

to be had. But it no longer is there merely for the asking. A real selling job has to be done to pry it loose.

The sooner all of us realize that selling is back as the No. 1 job of Metalworking, the better each manufacturer will meet today's and tomorrow's challenge to his own competitive position, to his own prosperity, and to the prosperity of the national economy.

Burnham Finney EDITOR

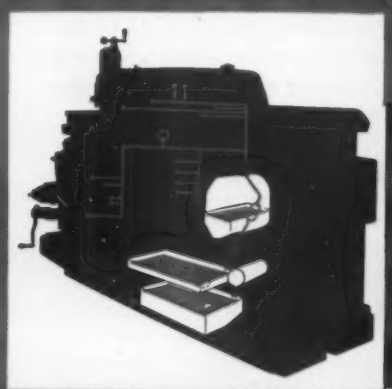
50 lbs. oil pressure

IS NECESSARY WITH A CUT LIKE THIS...

This tremendous cut demonstrates the ability of the 50-p. s. i. lubrication system to develop and maintain oil films under the heaviest loads.

It also demonstrates the strength, rigidity and power which are standard features on all Cincinnati Rigid Shapers.

Demonstration cut on Cincinnati Rigid Shaper. Actual size steel chip, 2" cut, .030" feed.



50 p.s.i. system includes 50 micro filter, settling basin and reservoir. Transmission runs submerged in oil.

☆ *Write Department A for Bulletin* **"Cincinnati Rigid Shapers"**

☆ The Electro-Magnetic Brake and Clutch with finger tip control are standard features on Cincinnati Shapers for maximum speed and ease of operation.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

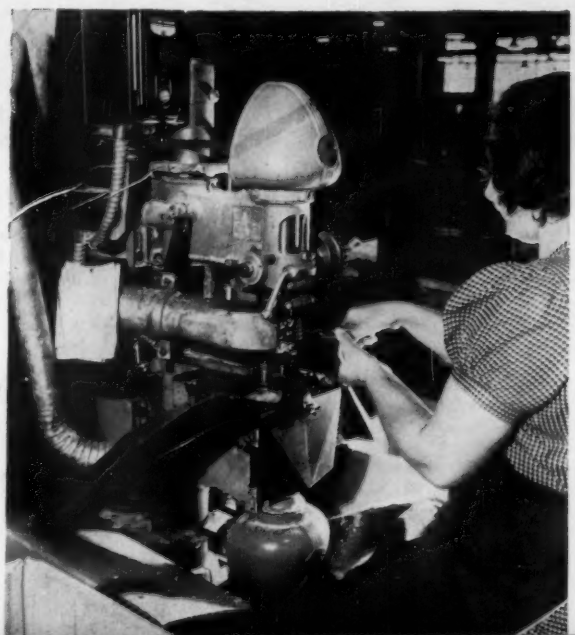
American Machinist

Milling two slots . . . simultaneously in one part is accomplished by mounting a movable fixture on the table of a drillpress. Cutter is mounted on a special arbor, containing a pilot which seats in a bushing in the fixture, to prevent displacement of the cutter. Two parts are clamped to the fixture. When the operator moves the lever, the parts pass the cutter; are then rotated 180° and slotted on the opposite side during the return movement

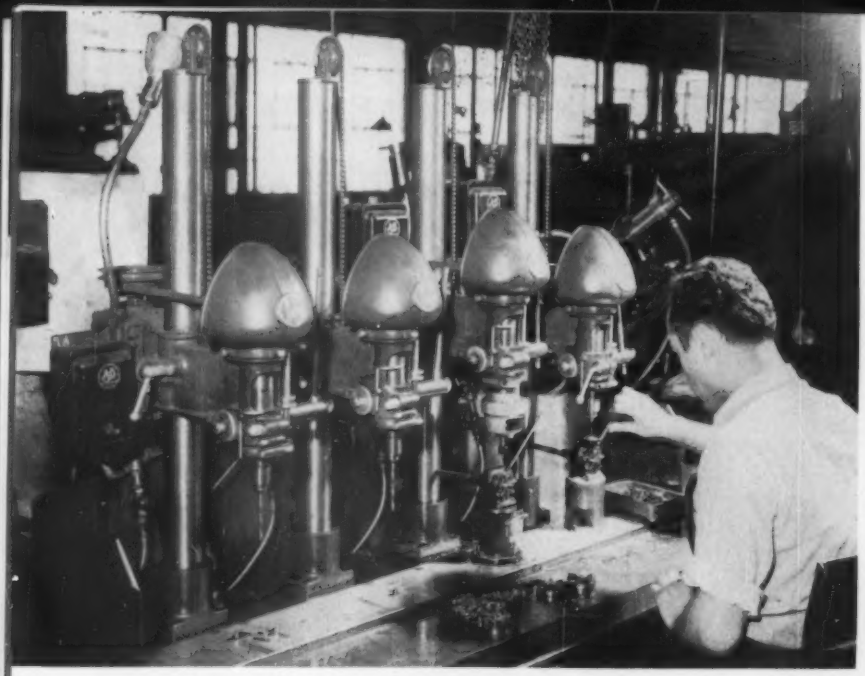
How drillpresses provide basic powered tooling

BY BEN ELDRIDGE, metalworking products manager
DELTA POWER TOOL DIVISION, ROCKWELL MANUFACTURING CO, PITTSBURGH

Each day brings new problems; new equipment needs. Shop people look around for the most expeditious and the most practical means for solving these problems. Drillheads provide a versatility that makes them frequent, and inexpensive, answers to many puzzles. We think you'll find many good ideas in these setups from a number of shops

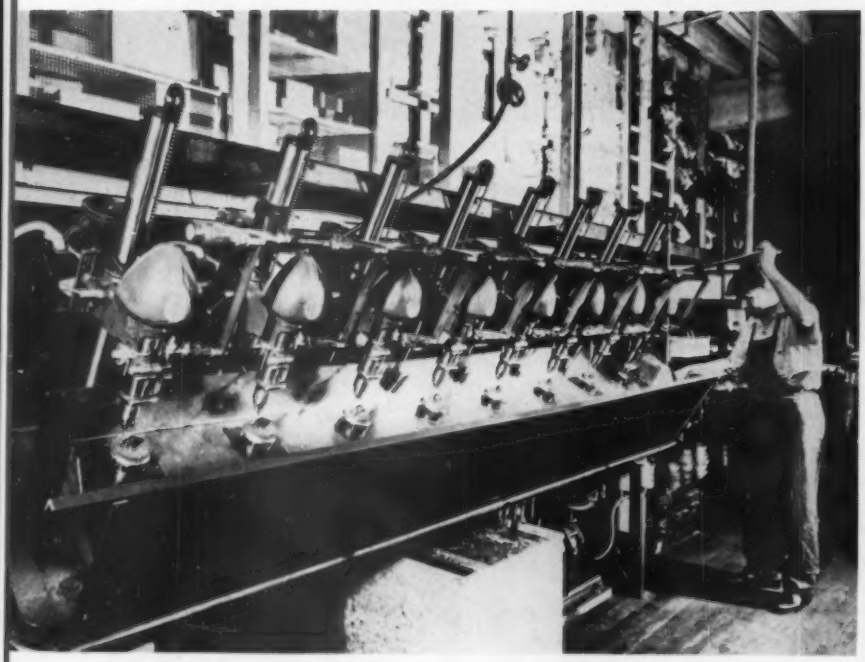


Counterbore top and bottom of hole . . . in small wheel, simultaneously, by mounting two drillheads on one column, one drillhead inverted. Chain-and-pulley arrangement between both spindle feeds and a pedal permits foot operation of feeds while part is hand held. In other setups opposed drillheads are synchronized to position two parts for welding, brazing, etc



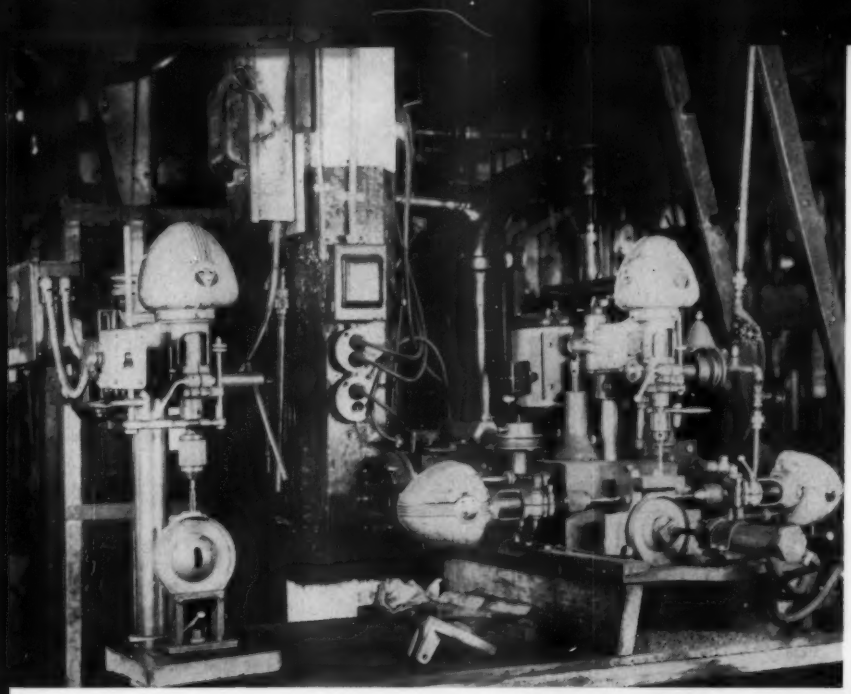
Basic powered tooling . . .

Movable fixture plate . . .
speeds setup on multihead drillpresses. Plates are made to hold fixtures used in sequence. Plate is attached to drillpress table with a pin and two socket-head screws at each end. Fixtures are attached to plate with two pins each for location and two socket-head capscrews. Plates are stored by part number, as are fixtures; the latter also have sequence numbers. For parts frequently run, fixtures may be left mounted on the plates between uses. Errors from table inaccuracies can be corrected in preparing the plate



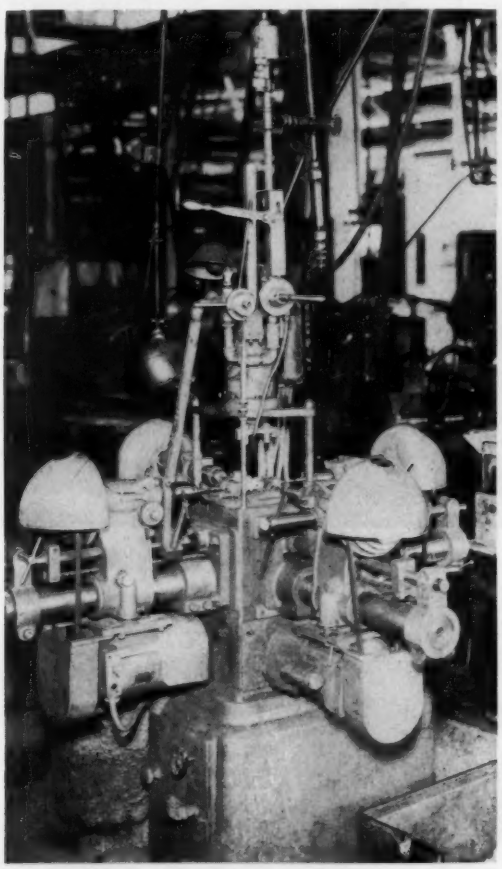
Eight parts are drilled . . .
in one operation—all by individual drillheads powered by individual motors but fed from a single lever. Presses are mounted on a sectional table which is slanted to make it easier to clean off chips and to improve coolant flow. Parts are held in indexable jigs and as many as 100 holes are drilled in each piece. *Ed note: Why not a lever at each end so operator can walk down line and index parts, then drill without returning to far end?*

720 pc per hr are tapped . . .
using this rotary fixture with a standard drillpress plus a tapping attachment. Operator loads and unloads pieces with left hand as he manipulates feed lever with right hand. Fixture latches in position beneath spindle at each station. Operation is almost as fast as automatic setup; is less difficult to set up



Three drillheads . . .
(right) drill three holes simultaneously in a casting. Operator takes a drilled casting and taps one of the holes on a single-spindle drillpress (left) while the special drilling machine is drilling the next casting. The three drillheads used for automatically drilling the casting are controlled by mercury switches and compressed-air valves. Tapping on the single unit also is semi-automatic; as soon as the tap reaches the correct depth it reverses. Note cable, pulley, and air cylinder used to simplify feed of drills

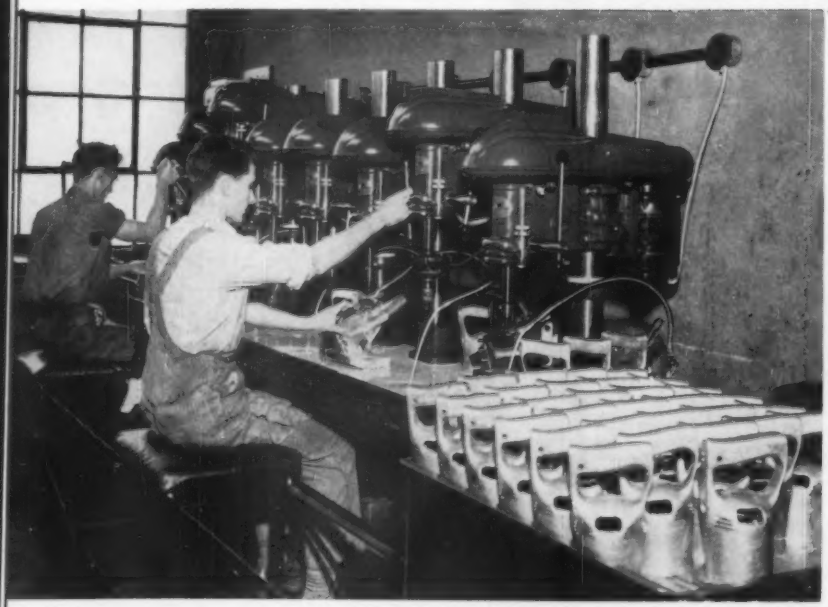
Auxiliary drilling . . .
is accomplished by mounting a drillhead horizontally on the table of a standard drillpress. Drillhead column is clamped in block, which is bolted to drillpress table. Thus hole is drilled in side of part as central hole is drilled from above. Similar arrangement can be made on most machine tools to avoid a "second operation"



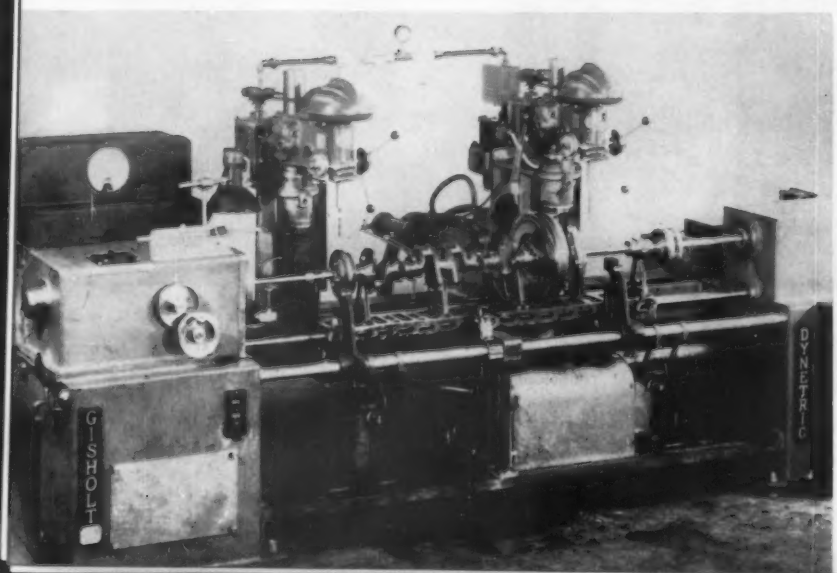
Special purpose drilling machine . . .
built with four standard drillheads, automatically drills holes in 250 furnace-burner manifolds per hour. Unit, controlled pneumatically and hydraulically, was developed at very low cost. Operator simply places manifold in fixture and presses start button. Roller chain and guide bar arrangement provides special feed to spindles, actuated by internal hydraulic cylinder

Basic powered tooling . . .

Multiple lapping . . .
with tolerances held between 0.000010 and 0.000020 in., is done 12 parts at a time on this homemade machine using standard drillheads. Extra pulley on driveshaft reduces spindle speed. Parts are held in twin disks attached to T-arm held in spindle. Cast iron lapping disk also slowly revolves, driven through large ring gear. Operator loads parts while machine is running and, even unskilled, can produce 1300 pieces in an 8-hr day



Seat on rollers . . .
riding on an angle-iron frame, gives these workers a comfortable ride from drillhead to drillhead in this setup for operations performed in sequence. Roller seat both speeds work and reduces fatigue. Man on left passes work to his neighbor after completing sequence. Setup includes coolant system which supplies each press. Drillpresses are designed as sectional-table units which can be assembled into a setup a "block long" if needed



Special balancing machine . . .
was designed to balance 6- and 8-throw crankshaft assemblies. Machine locates and measures unbalance in all rotating parts in one operation. Two drillpresses, mounted on the machine, remove just the right quantity of metal to balance the parts without disturbing the setup, thus saving time and preventing errors caused by removing the part from the machine for drilling

Preload bearings using friction coefficient

R J ASPEEK

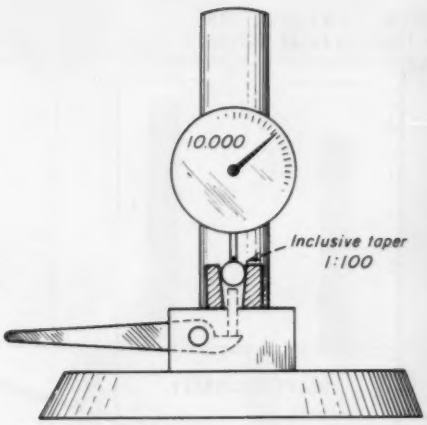


Fig. 1.. Fixture with tapered bore and a "tenth" dial indicator selected balls to one micron

In England, during World War II, we had to develop precision spindles for diamond boring aircraft-engine main and connecting-rod big-end bearings. Specifications for surface finish on the work were 8 to 10 micro-inches. Our solution involved a gage to select balls to one micron for diameter, and the use of the coefficient of friction for hard steel in indirect measurement of the preload applied to the bearings.

The bearings ranged in size from ⅝ to 4 in. OD, and the spindles were to be operated at speeds ranging from 30,000 to 90,000 rpm. Bearings were rebuilt in this fashion:

The bearings were dismantled and the bronze cages discarded. New cages were made from laminated bakelite, and so that they centered on the balls and were free of the inner and outer races. Under high-speed operation, the bakelite would not gall, would hold together under high centrifugal stresses, and also absorbed oil. The inner and outer races, which were usually of the single-row deep-groove type, were checked on a button rig with a "tenth" dial indicator, for concentricity of the OD to track and ID to track. Errors of 0.00005 to 0.0001 were common. Matching sets of inner and outer races were selected and marked for individual error.

Balls were selected by use of a fixture bored and lapped with a taper of 1:100, and a "tenth" dial gage. Diameters could be selected to one micron, because one division on the indicator dial represented one micron variation in ball diameter. A small trip lever, set slightly off center in the gage, enabled us to lift and turn the ball to a new measuring position without rehandling. The lowest reading was, of course, the correct one.

In handling the balls, we placed them in a cup of gasoline to stabilize temperature, and used tongs when picking them out to avoid the effects of body heat. A ¼-in. ball held in the hand would grow 2 microns in 10 sec, we found.

Bearings assembled from selected parts were preloaded in this fashion. Inner and outer spacers were employed, Fig. 2. Load adjustments were obtained by lapping the inner or outer spacer to increase or decrease the load on any race. This is normal practice, but the innovation was the indirect measurement of the load on each race.

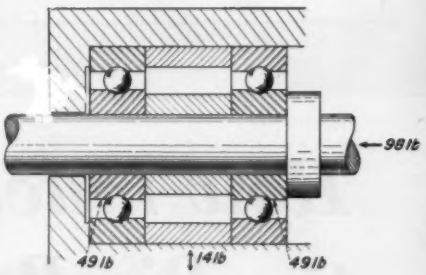


Fig. 2.. Desired preload on races is achieved by slipping the spacers with a pull equal to preload times coefficient of friction

LOAD TO SLIP

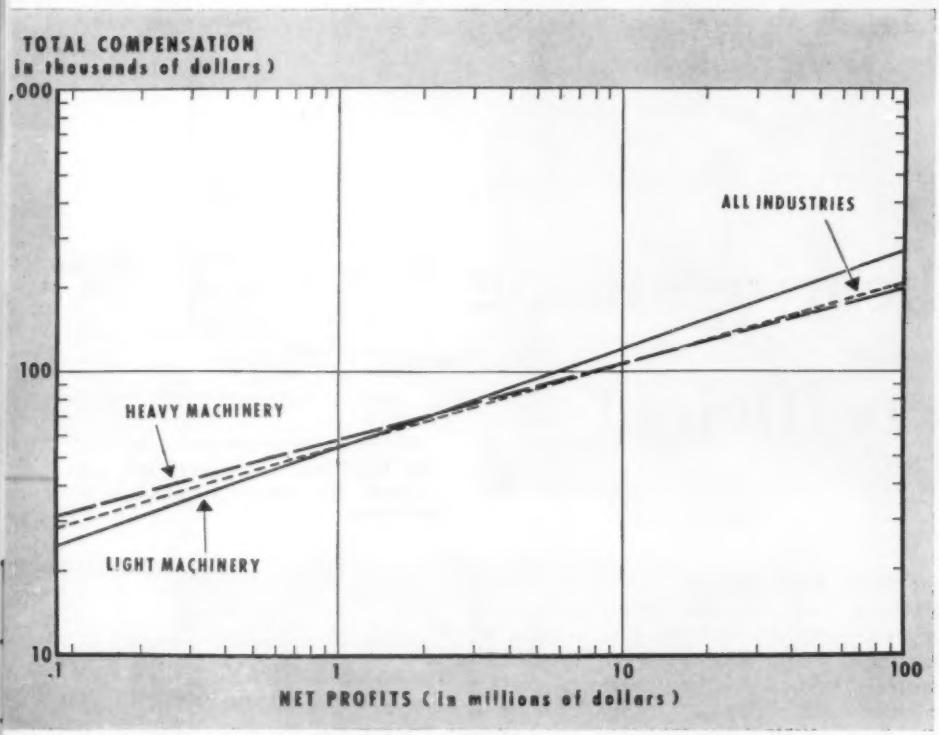
The coefficient of friction of hard steel against hard steel is 0.14. By applying a known load against the race, the outer spacer is lapped until the load to slip the spacer radially is 0.14 times the desired preload—in this case multiplied by two because two frictional faces were involved.

Example (Fig. 2): Total load required equals 98 lb, or 49 lb for each of the two races. Note: the outer spacer should transfer 49 lb pressure to the second race. The load to slip the spacer is therefore $0.14 \times 49 \times 2 = 14$ lb.

This method of checking preload can be applied to a number of races loaded in tandem, either spring loaded or solid loaded. We found it practical to set up as many as three bearings in tandem by this method.

To prevent the bearings from developing a recurrent waviness in the bored surface, we used a different number of balls in the respective bearings.

To provide a setup free of clamping stresses, as on a large casting on a planer, it might be feasible to use the coefficient of friction. The jacks would have friction-disk heads and be operated with torque wrenches until the desired clamping load has been achieved.



Chief executive officers are paid more in larger companies than in smaller (with net profit taken as index of size). But compensation rises at decreasing rate as size increases

How much should the Big Boss get?

And how about the second, third and fourth ranking men in metalworking companies?

If you have a clear understanding of average executive compensation levels, you can more easily develop a program to meet your own particular needs

ROBERT G AXTELL,
McKINSEY & CO INC
management consultants

The annual income of the top management of American companies is related directly to the size of the companies. More than that, the chief executive officer of a large company receives a higher income than the chief executive officer of a smaller company. The amount of compensation, on the other hand, rises at a decreasing rate as the size of the company increases. Net profits, incidentally, is taken as the index to size.

Sharp variations occur between one industry and another in the income, in salary and bonus, received by management. The best kind of comparison is between groups in the same industry rather than between two totally different industries.

The compensation paid to the chief executive officer of a company has a direct bearing on the compensation of those directly under him (those whose salaries and bonuses add up to $20,000 a year or more were included in the study).

These are some of the interesting and revealing conclusions that have come out of a study made by our company of the executive compensation data filed by 606 companies in 18 major industries with the Securities and Exchange Commission. Some 113 of these companies are in the heavy and light machinery and metal products industries. The study as a whole is discussed by Arch Patton in a recent issue of the Harvard Business Review. This article confines itself to a discussion of the findings about manufacturing companies in the

light machinery and heavy machinery industries.

The chief executive officer of a heavy machinery company with a net profit of $3 million in 1955 received $76,000 as compensation for his services, the averages show. By contrast, the top man in the same kind of company with a net of $10 million got $107,000. The same general relationship of income to the size of net profits existed in the light machinery industry. Beyond that, the same kind of financial pattern runs throughout all of industry.

The light machinery industry appears to be more sensitive to fluctuations in profits than the heavy machinery industry, the study brings out. But the difference is small. The difference between levels of compensation at a given volume of profit is slight.

Compensation of a chief executive officer in a heavy machinery manufacturing company was more sensitive to increases and decreases in sales than in the light machinery industry. However, in either industry the amount of compensation **rose or fell quickly** as sales fluctuated. This fact confirms the growing importance of profit-based bonuses in both industries.

The study further reveals that the relationship of the compensation of other management executives to that of the chief executive officer is generally predictable. The relationship of the second, third and fourth highest paid executives to the top man, in fact, was virtually the same in the light and heavy machinery industries. The fluctuations of the chief executive's income were reflected in the incomes of his main subordinates.

Wide differences were uncovered in the study when comparisons were made between industries with little or nothing in common. To cite a case: The head of public utility company that earned $10 million in 1955 could expect to get $60,000 in compensation. A department store president whose company earned the same sum, on the other hand, would receive $130,000.

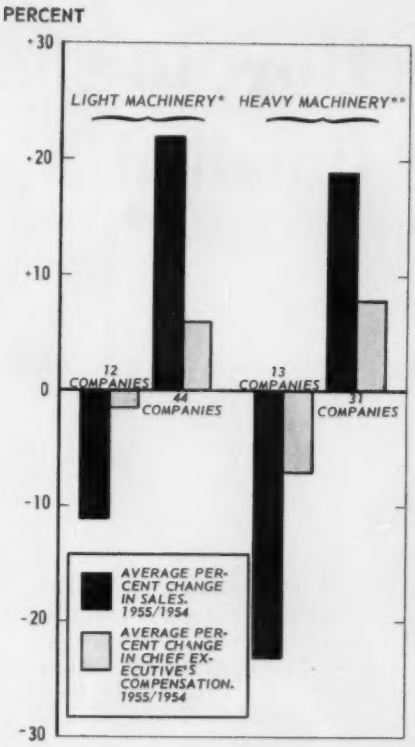
These sharp variations in income are believed to be caused by the difference in the degree of risk and responsibility assumed by the chief executive officer. Where committee management exists and the possibility is small of increasing profits sharply, as in public utilities, executive compensation tends to be lower than in cases in which greater direct individual responsibility holds.

Executive income quickly reflects fluctuations in sales, thanks to profit-based bonuses

Our study also took into account executive "fringe benefits." Stock options and deferred contingent compensation are chief among them. In the light machinery industry, 56% of the companies have adopted some form of stock option. The proportion is 50% in the heavy machinery industry (as against 47% for all of industry). About 17% of the heavy machinery industry companies are using deferred contingent compensation for top executives, and 20% of the light machinery industry companies (compared with 17% for industry as a whole).

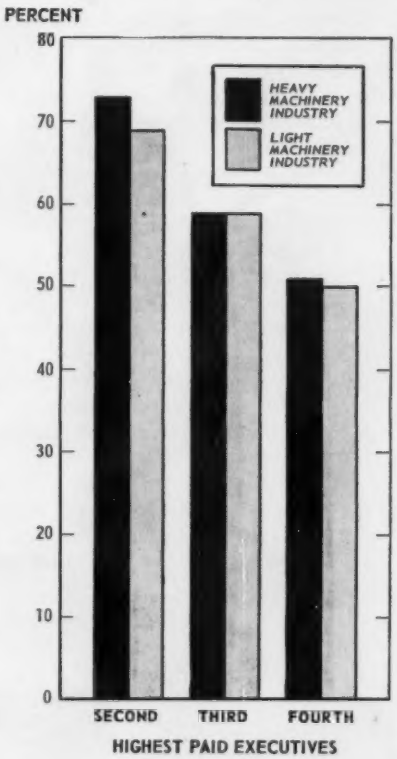
No study can hope to determine exactly how much any individual executive of any individual company should be paid. It can only establish a median figure. The final figure will depend upon the responsibilities assumed, the decisions made, and, in many cases, the tenure of the position. The sales head is the second highest paid executive in numerous companies. Within the same industry, however, the manufacturing or financial head may be second.

We studied the compensation of the chief executive because information about his income is readily available and because his is the only position in any given company which is clearly comparable with the like position in any other company. What's more, the compensation of other officers is dependent upon what the chief officer receives.



*DOES NOT INCLUDE SEVEN LIGHT MACHINERY COMPANIES THAT REPORTED LITTLE OR NO CHANGE IN SALES VOLUME, 1955/1954.

**DOES NOT INCLUDE SIX HEAVY MACHINERY COMPANIES THAT REPORTED LITTLE OR NO CHANGE IN SALES VOLUME, 1955/1954.



Compensation of other key executives is closely tied to that of chief executive

How to shape finished airfoils from solid stock

A unique three-dimensional miller developed for the National Advisory Committee for Aeronautics produces finished shapes in a single pass through two cutting heads

JESS S W DAVIDSEN, chief, mechanical engineering branch,
Engineering Services Division, AMES LABORATORY, NACA, MOFFETT FIELD, CALIF

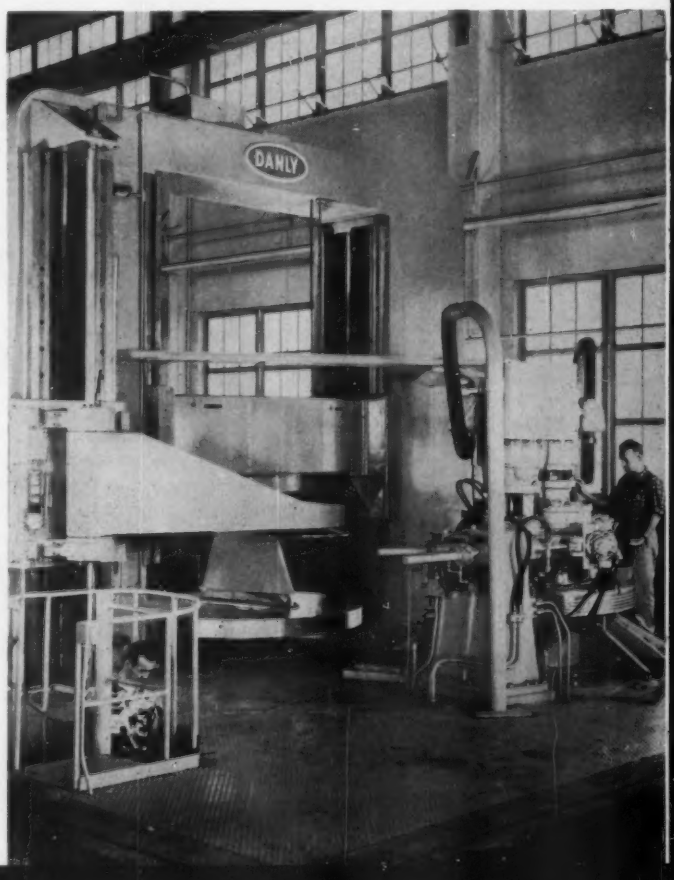
A 150-ton airfoil milling machine (see cover), capable of sculpturing in metal a complex three-dimensional shape like an airplane's wing or the twisted blades of an axial-flow air compressor, is now in use by the NACA's Ames Aeronautical Laboratory at Moffett Field, California, in its work of scientific research in aeronautics. The unique machine tool, only one of its kind in existence, was developed and built to the requirements of the Federal Government research center by Danly Machine Specialties, Inc., Chicago.

The new airfoil mill is the most advanced development in a series of machines the National Advisory Committee for Aeronautics has been using for 30 years to produce in metal the very accurate airfoil shapes required for research purposes. The products of these machines have been used as models in tests in supersonic wind tunnels and as essential parts of the driving machinery of the wind tunnels themselves. The new machine at Ames Laboratory, for example, has been used to mill a series of blades now installed in the main drive compressors of several large wind tunnels at the laboratory.

Advanced aeronautical research, which is the NACA's main responsibility, deals with complex curved shapes and with scale models which must meet rigid tolerance requirements. Thus the Federal agency has taken the lead in adapting existing machine tools to its special needs and in encouraging the development of special machines to meet its unusual requirements.

Airfoil mills are essentially machines for duplicating in metal a complex two- or three-dimensional curved shape generated by tracing a prepared pattern. In the Danly airfoil milling machine a wooden pattern is mounted vertically on a circular revolving table. Two large tracer wheels are held in contact with the pattern and as the table revolves the motion of each tracer wheel is transmitted to its individual milling cutter. The cutters are positioned against the metal blank to be machined which revolves at the same speed as the pattern. In this way the cutters shape the metal blank to the same curve as the wooden pattern.

The table rotates the work at a variable speed in order to equalize cutter feeds around the periphery



Wooden pattern is mounted vertically . . .
on the circular revolving table in the foreground on the Danly airfoil milling machine

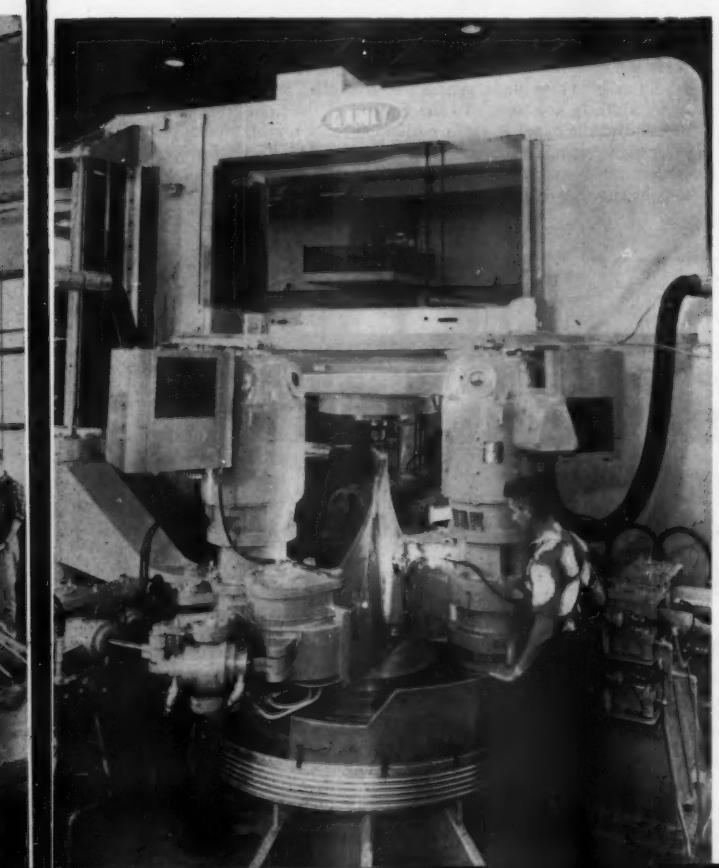
of the blank being machined as the part turns. This action equalizes cutter pressures and produces a uniform finish.

Action is fully automatic once the pattern and work blank have been put in place. The mill is capable of machining shapes lying within an 18-in. square by 96 in. long. Thus chord dimensions of around 24 in. are possible. The mechanism for holding the metal work blank to be machined can exert an upward thrust of 8,500 lb. Both pattern and work are mounted vertically, in contrast to previous airfoil mills of horizontal design. This mounting method eliminates inaccuracies of bending that could result from the weight of the metal blank being shaped.

The sub-floor area is 25x25 ft by 15 ft high and contains a smaller pit 8 ft deep and 6 ft in diameter. The latter pit accommodates the mechanism for the turntable on which the work rides. The machine rises 17 ft above the floor and occupies an area of more than 600 sq ft.

Seventeen electric motors are required to operate the new airfoil machine. Two spindle motors of 75 hp each drive the milling cutters which shape the work blank. Other motors turn the table on which the pattern is mounted, provide lubrication, pressurize the complex hydraulic system of the machine and furnish cooling where necessary. The total motor horsepower is 425. Nearly 80,000 feet of wiring has been used in the machine and in its electrical control panel. The control panel, weighing 25 tons, was supplied by Reliance Electric & Engineering Co.

In automatic position, the speed of the dc motor on the pattern-table drive is varied according to the depth of the cut and the speed of material feed. The pattern motor is fed from a generator, which in turn has its field controlled from an exciter. The signal controlling the exciter comes through a high-gain amplifier and is the differential voltage between the output tachometer on the pattern motor and the selected speed signal. This selected speed signal can either be set manually or through a variable reactance dancer roll that is cam operated from the pattern table.



Rough and finish cutters . . .
operate just above the face of the chuck for maximum rigidity as work is pushed up through hydraulic clamps

HYDRAULIC CHUCKING METHOD

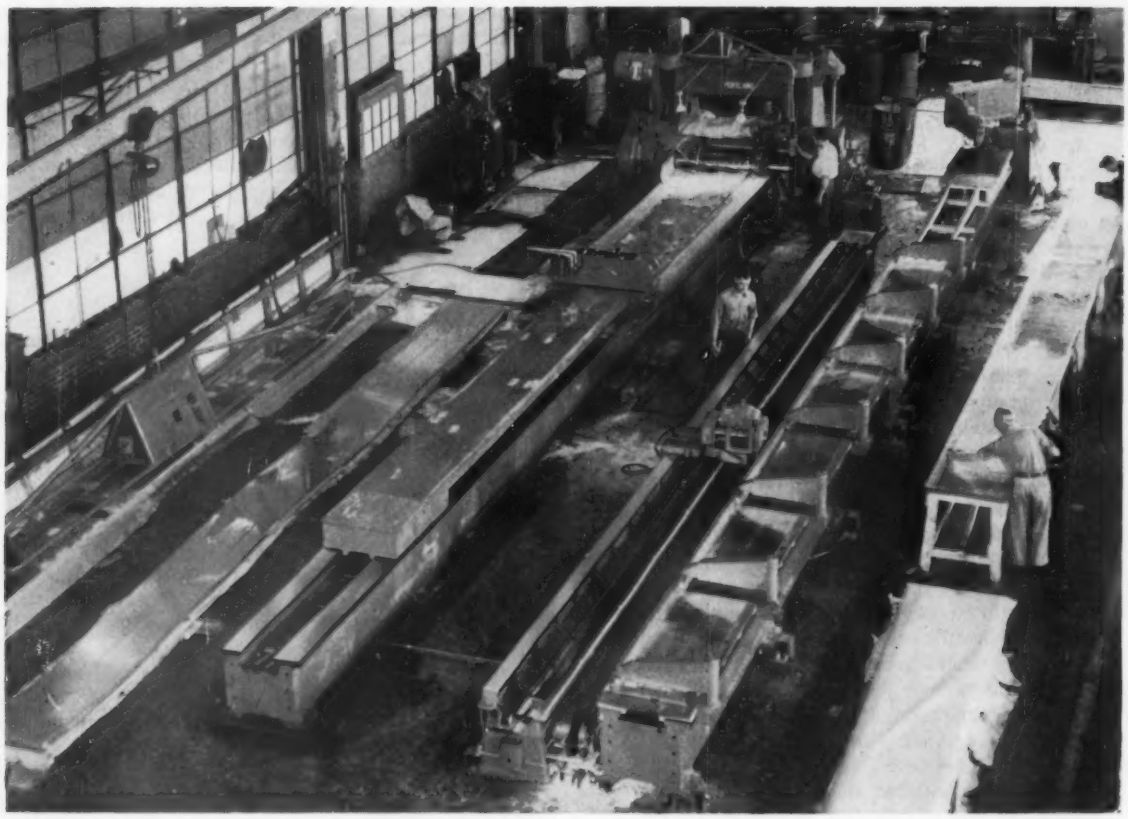
The airfoil contour is developed by tracing a master pattern four times the size of the finished part. In milling a wing model with a thin trailing edge, say 0.003 in., the pattern is made four times finished size plus a 1-in. radial blowup to prevent tracer-wheel damage to the pattern. Cutter- and tracer-wheel diameters are then selected to eliminate the blowup allowance on the finished work. It is also possible to exaggerate or diminish the vertical dimension of a master pattern which permits balancing greater accuracy against master pattern costs.

A hydraulic tracer system built by Cincinnati Milling Machine Co. transmits the motion of the tracer wheels to the rough and finish cutters (which operate simultaneously on opposite sides of the work). The work is fed up through the chuck and past the cutters, which generate the finished airfoil section in a single pass. The blank usually has a square or rectangular shape to permit positive chucking. Both cutters operate just above the face of the chuck for maximum rigidity. The work rests on a lift platform that pushes it up through the hydraulic clamps.

For working forgings incorporating large amounts of twist, Ames Laboratory has developed a special chuck using serrated jaws to guide the work. One of the jaws is beam-loaded to permit adjustment of the holding force on the work. As the lift platform pushes the forged blank upward through the chuck jaws, the vertical serrations provide a firm grip on the work, thus keeping it in phase with the master pattern and permitting only vertical movement.

A wide range of flexibility has been built into the machine so that it can work in various materials. For cutting alloy steels a speed range of 78 to 785 fpm is available; for aluminum alloys speeds between 314 and 3140 fpm have been provided. The Danly machine is capable of working to an accuracy of better than ±0.004 in. over chord lengths up to 24 in.

Primary advantage of the new machine is its ability to produce in one milling operation an airfoil shape of complex curvature at a fraction of the time and cost required to produce a similar shape by conventional machine tool and handwork methods.



Plain tooling . . .

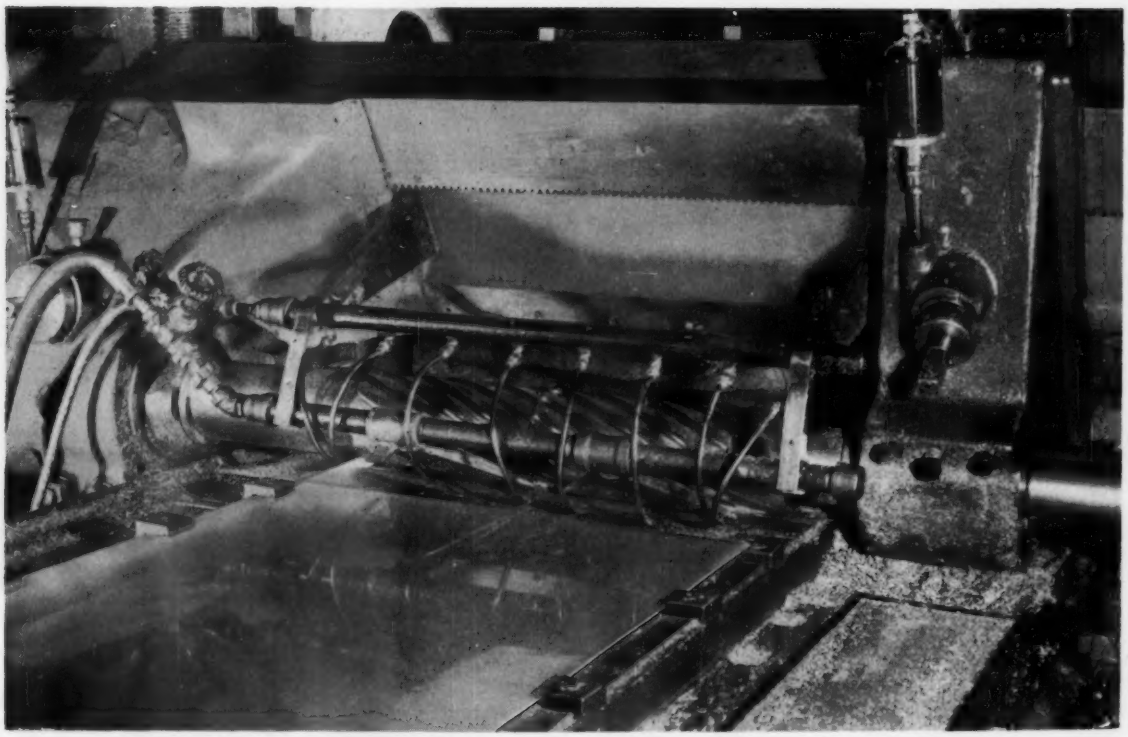
coupled with an in-line machine setup produces skins eight times faster. Actually the setup above is quite logical for the problem involved, but for some reason was not hit upon by engineers at other plants. The problem involves machining a uniform taper on aluminum (7075-T6) lower-surface wing panels 37 ft long and 27 in. wide. Taper runs from 0.080 in. at one end of panel, and gradually increases for a length of 13 ft to a thickness of 0.155 in. The same taper is then machined on the opposite end of the panel. The panel is next shuttled over to a workholding table with mechanical clamping (center) where it is machined to correct width. Here a sprocket-chain drive feeds a power-driven saw past the full length of the panel. A 10-in.-dia carbide saw blade, running at 4700 sfpm and 50-fpm feed, trims width in one pass. To the far end of the same worktable, one end of the panel is again positioned for a routing operation. All machining tolerances are held to ±0.005 in. Final operation is performed on the inspection bench (extreme right). Floor-to-floor time for entire operation is 1¾ hr

Tooling alone achieves tight

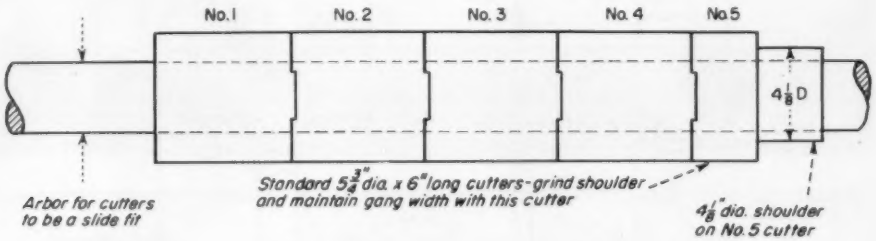
. . . *No machine capabilities or operator*

CLAUDE TRIBERT, chief engineer
PORTLAND MACHINE
TOOL WORKS, INC
PORTLAND, MAINE

Here are two case studies to illustrate how a group of engineers build into production tooling the ability to perform difficult machining operations without relying upon capabilities of the best machines and operators within the shop. Their attitude toward tough machining problems is First—look for the most obvious tooling solu-



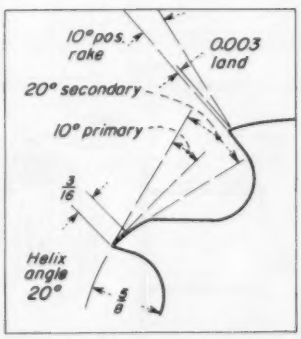
Design of tapered workholding-table . . .
although hardly startling, proved to be the biggest time saving factor in over-all operation. Because desired taper was incorporated into the CI table, rise and fall of the cutter was eliminated, thereby permitting greater stock removal at higher speeds and feeds. Table initially had mechanical clamping to facilitate immediate production; now has a vacuum chuck. Helical cutter is made up of five interlocked standard cutters to span full width of panel and climb-mills at 1800 sfpm with a 7.5-ipm feed

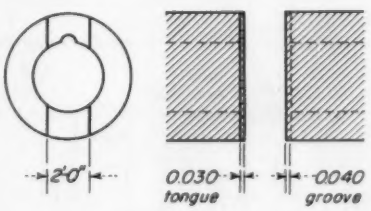

No. 1
No. 2
No. 3
No. 4
No. 5
4⅛ D
Arbor for cutters to be a slide fit
Standard 5¾" dia. x 6" long cutters - grind shoulder and maintain gang width with this cutter
4⅛" dia. shoulder on No. 5 cutter

tolerances

skills needed

tion. Second—Design the tooling along lines that will require just one motion of the machine; all other motions are locked out during the machining cycle.





Tongue and Groove Cutters

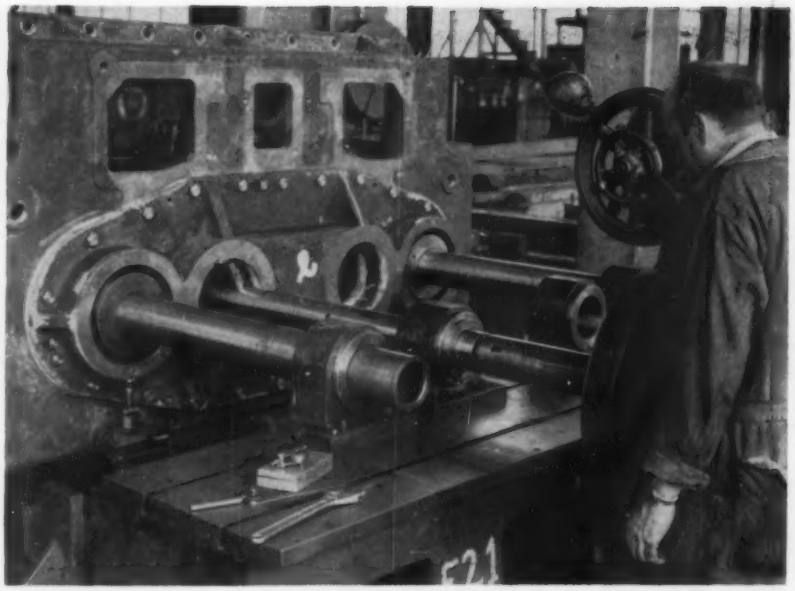
Design of slab mill . . .
shows how five standard cutters are interlocked. Cutters are then mounted on machine mandrel for modified grinding of cutter angles

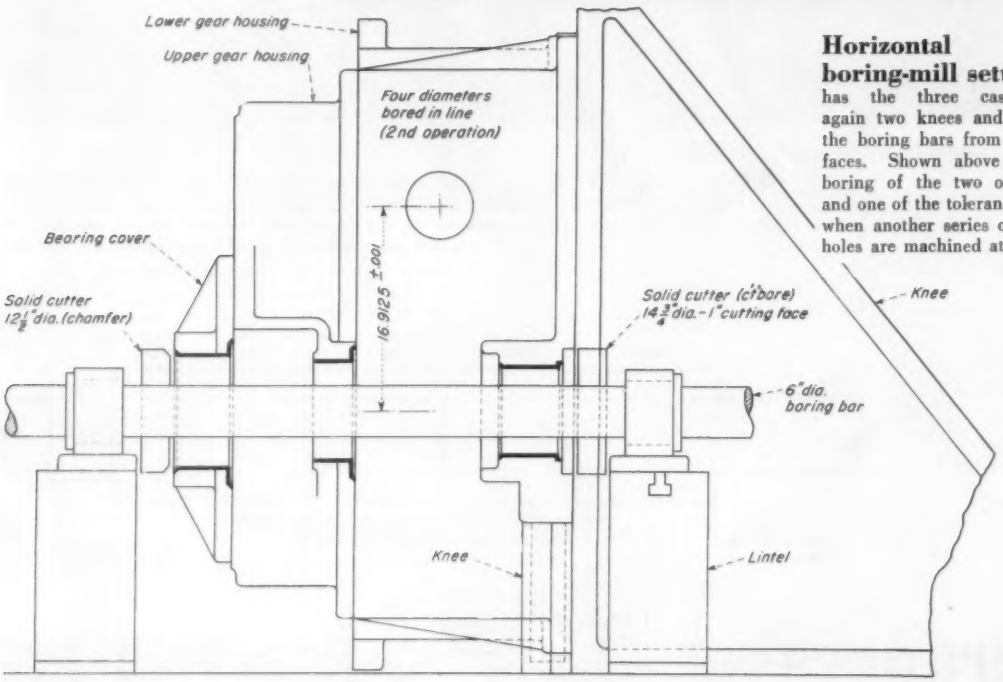
PLEASE TURN PAGE ▶

Tooling alone achieves tight tolerances . . .

Three castings totaling 28,000 lb . . .

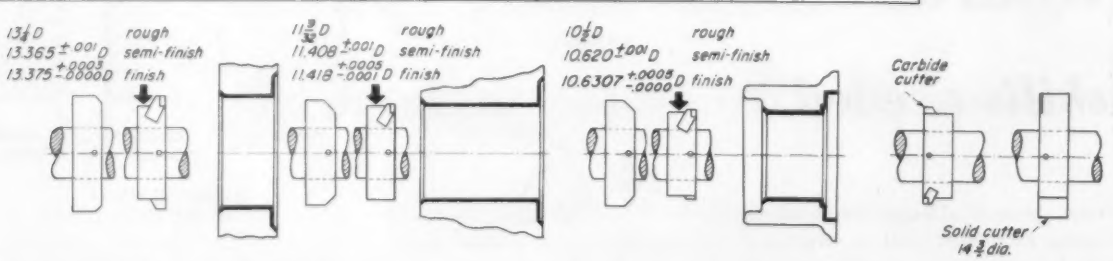
are bored in line on a production setup to tolerances of ±0.0003 in. between centers, and ±0.001 in. from previously machined surfaces. This series of illustrations show how the tooling and setups alone consistently hold the prescribed close tolerances. The two outboard holes are bored first. Guide bars and locating plugs are then inserted into these holes to maintain alignment, and to establish reference surfaces for checking centerline relationship between two inner holes and outboard holes. Flat rectangular cutters, solid or carbide tipped, are preset to bore diameter in correct station on boring bar





Horizontal boring-mill setup . . .

has the three castings banked again two knees and positioned to the boring bars from reference surfaces. Shown above is the in-line boring of the two outboard holes, and one of the tolerances maintained when another series of in-line-bored holes are machined at another setup

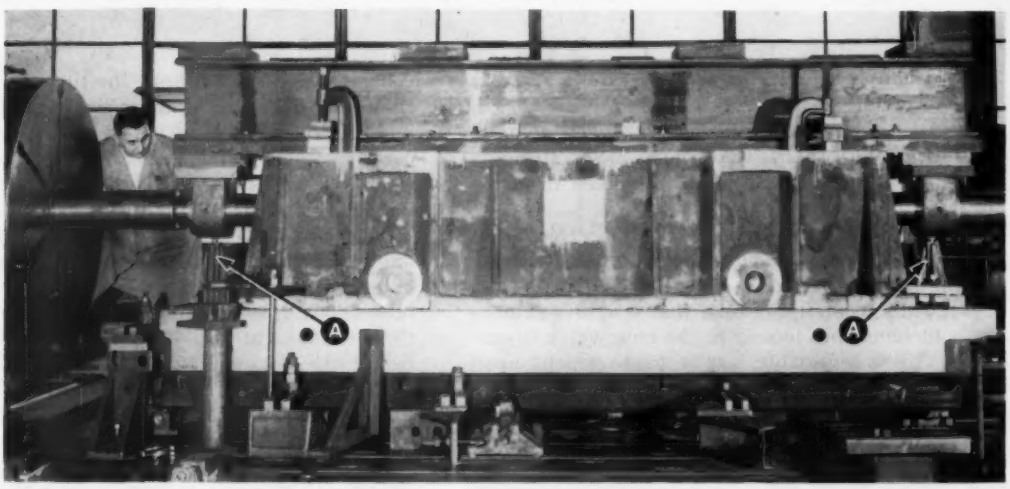


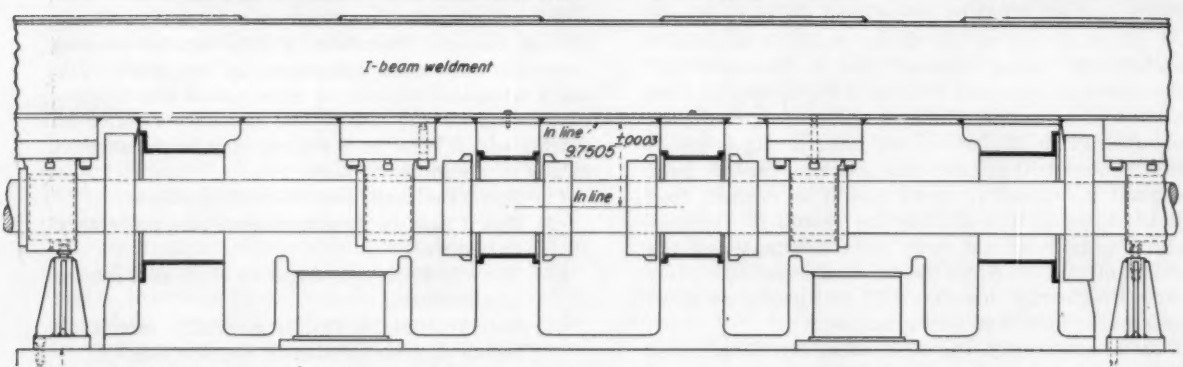
Sequence of boring operations . . .

shows the cutters, all 1 in. thick, in their relative positions in the boring bar. Each phase of boring, counterboring, and chamfering, has a set of cutters precisely positioned in the boring bar for the individual operation to permit finish machining in one pass

Second operation for in-line boring . . .
of lower gear housing locates the previously bored outboard holes on plugs and banks against the same reference surface used in first operation. Locating plugs were aligned optically and their center-to-center distance checked with a master gage. Buttons on top of the plugs and master gages are used to establish the 16.9125±0.001 in. dimension (see first boring mill setup) to the centerline of boring bar fixture, shown left atop casting

Boring fixture
fabricated from an I-beam weldment maintains a tolerance of ±0.0003 in. from the top face of the casting to the centerline of the bore. Two optically aligned locating plugs, A, position the boring fixture to within ±0.001 in. of holes bored in first operation





(2) Plugs align boring fixture to ±0.001" of previously bored holes

In-line counterboring operation . . .
is completed by one pass of the boring bar forward and in reverse. Through holes were machined by a set of rough, semi-finish, and finish, carbide cutters inserted into the boring bar in the previous step. Note that the ±0.0003-in. tolerance is inherent within the boring fixture and that the over-all accuracy of the job is a function of sound tooling and not a result of the operator's skill or the machine's capabilities

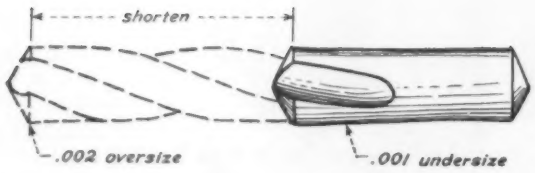


Fig. 1

Fig. 2

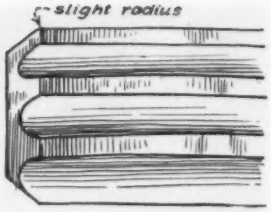


Fig. 3

HOLE PROBLEMS: *how to solve*

It's too bad we can't order "clearance", "slip-fit", or "press-fit" holes by the gross. It would save a lot of trouble. Actually, the business of producing custom holes, a few at a time, remains a real and challenging problem. Over the years a number of rough-and-ready methods of cutting holes to exact size have been developed, and here are some of them. Warning: These ideas may not be considered best shop practice, especially if the customer is going to be touchy about the job. They are just possible "outs" when you are really up against it . . . and no guarantees

Drills usually cut oversize because of one or more of three factors:

(1) Drills average 0.001 to 0.002 over nominal size to start with (about 0.0015 for a ½-in. straight-shank jobber's-length HSS drill, as taken from the box).

(2) Anything less than an absolute perfection in grinding lip angles will put the point off center with one lip cutting oversize.

(3) Chip geometry is such that a drill will normally fit somewhat loosely in the hole which it produces. This is a variable, and seems to depend upon speed, feed, coolant, and chip temperature; as well as the material being worked. However, a drill can be made to produce a hole which is to size or slightly under and give a press-fit for a standard hardened and ground dowel pin without requiring reaming. Drills average 0.003 in. of taper in the flute length. At the back end of the flutes, the drill is usually about 0.001 under nominal size. A shortened and discarded or worn-out drill, as in Fig 1, may be used almost as a reamer. The hole should be pre-drilled about 1/16 in. undersize, and the cutting edges of the reamer-drill ground with extreme care. A good coolant is necessary; speed should be normal, feed light. As in all fine drilling (or reaming), the machine spindle should have tight bearings and the chuck or tapered drive socket should run absolutely true. Frequently this stub drill will produce a more acceptable hole than will a reamer.

In an emergency, the same effect can be achieved to a degree in this manner: For a ¼-in. hole, use a normal 'C' drill; for a ⅜-in. hole use a 'U' drill. Do not alter the drill; merely be certain that it is ground properly. Drill from the solid or with a very small lead hole. Use a fast speed, heavy feed, and lots of coolant. This is, of course, inviting the drill to cut somewhat oversize. As the 'C' drill is only 0.008 in. and the 'U' drill only 0.007 in. under nominal, pins can usually be driven directly into the holes they produce without any reaming or other operation. For larger sizes of drills, take a worn drill of nominal size, grind the cutting edges carefully for equal angle and length, and then stone a radius at the outer angle of the cutting edge, Fig 2. Predrill the hole about 1/16 in. undersize, use lots of coolant, clear the hole of chips frequently, and hope for the best.

REAMERS

A reamer will produce an undersize hole if it is worn undersize to start with, or is dull, or is flooded with coolant, and is operated in a machine with no spindle runout. Therefore, a hole can be reamed undersize with good equipment in two ways: (1) use a worn-out reamer, or alter a new one to simulate wear, or (2) reduce the aggressiveness of its cutting edges. Wear on a reamer may be accelerated in any of a number of ways:

(1) Stone the lands and the cutting edges
(2) Run it backwards in a reamed hole, preferably in cast iron
(3) Work it down with abrasive cloth as it rotates in a drillpress
(4) Etc. (ruining a tool is normally something which anyone can devise ways to do).

The aggressiveness of the cutting action can be reduced by lightly stoning the cutting angle as shown in Fig 3. The advantage of this method, of course, is that the reamer can be restored for normal use by simply regrinding the cutting-edge angle.

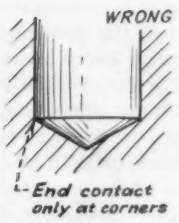
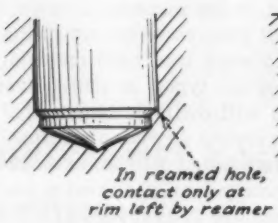


Fig. 4A



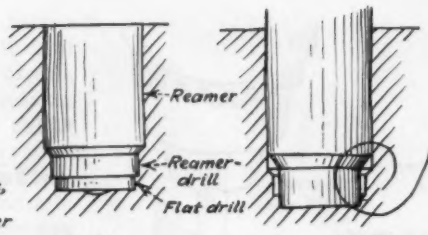


Fig. 4B

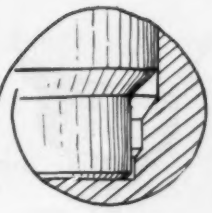


Fig. 4C

some of them

BUCKLEY SULLIVAN,
consulting tool & die designer

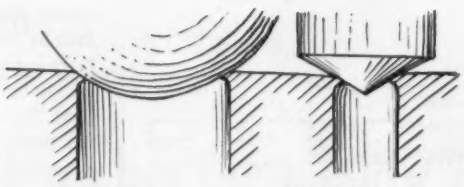


Fig. 5A

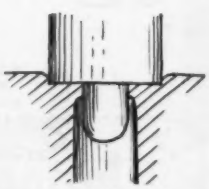


Fig. 5B

HOLE AND PIN DESIGN

Inasmuch as a large percentage of press-fit applications involve blind holes, a few thoughts on the subject may not be wasted. If the pin is to take an end load or its end is to be located accurately with respect to the surface of the work, the hole should have a flat bottom, Fig 4a. This is readily produced with a drill ground flat on the end; that is, the cutting edges have an included angle of 180°. The drill should be one size smaller than the drilled hole to prevent enlarging it. A flat-bottom hole which has been reamed therefore will have two steps near the bottom of the walls: One step where the reamer stopped cutting, and one step where the original drill stopped cutting, Fig 4b. To clear these steps and to aid in starting the pin square in the hole, it is necessary to grind or otherwise machine a slight shoulder at the end of the pin, Fig 4c. This will give the pin good bearing against both the sides and the bottom of the hole.

HOLES

Once a hole is produced in soft material, such as cold-rolled steel, it may be found to be undersize, on size, oversize, or out of location. An undersize hole is enlarged, and an on-size hole is accepted with thanksgiving. An oversize hole may be salvaged in any of a number of ways, all dependent upon upsetting the rim into the hole to reduce its diameter. Except in through holes where both ends may be treated, none of the treatments are very successful because of lack of bearing surface for the pin. However, they may be useful in an emergency.

The diameter of the pin may be enlarged somewhat by mutilating its entrant end by upsetting, knurling (if soft), or by hammering. Similarly,

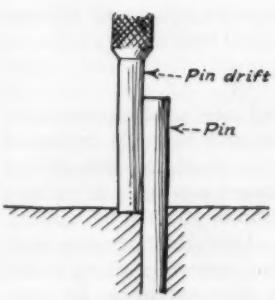


Fig. 6A

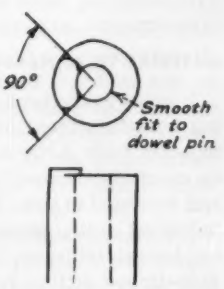


Fig. 5B

the hole size at the rim may be reduced by hammering in the edges. This may be done by a punch or hardened steel ball, Fig 5a. Use care: If too much of the wall is upset, it may have to be enlarged again to allow entry of the pin. If much work of this nature is expected, a set of piloted punches, Fig 5b, may be made up, hardened and ground.

If the hole is a few thousandths off location, or is drilled a bit off square, some correction may be made. The simplest is to swage one side of the hole with sufficient pressure to cause the pin to compress the opposite side and thus effectively change its location. The simplest method is to use a hardened pin drift, Fig 6a. Again, if much work is to be done, hardened tools should be made, as in Fig 6b, which is a design that works well in practice. The tool is made of good chisel steel, drilled out at the business end to fit over a pin inserted in the hole of the workpiece. About 75% of the face of the tool is relieved. This leaves a quadrant of 90° as the actual working area. By placing the tool over the pin in such a fashion that the working face of the tool is diametrically op-

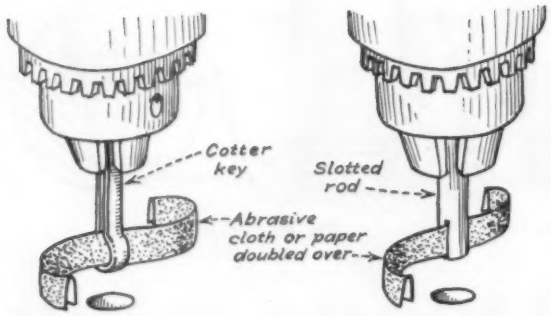


Fig. 7

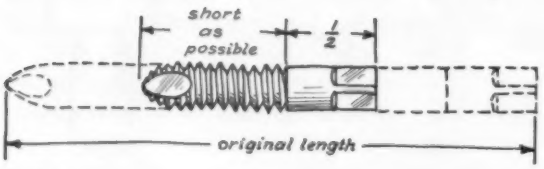


Fig. 8

posite the direction of desired movement of the pin, the area surrounding the pin can be swaged down with sufficient force to move the pin, under normal circumstances, as much as 0.010 inch.

MATERIAL TO BE HARDENED

If holes in the type of tool steel used expand during heat-treatment, they should be made undersize to begin with. After heat-treatment, the hole should be carefully cleaned to remove any scale or residue and enlarged to suit. This can be effected by lapping, polishing with abrasive cloth, drilling out with hard-steel drills, or, in some materials, using a carbide-tipped drill or reamer. Simple laps can be readily made up as shown in Fig 7. In some cases, it may be easier to chuck the pin in a drillpress and work it down to fit the hole by polishing with abrasive cloth. If the dimensional change of holes in the material during heat-treatment is inconsistent, sometimes being over size and sometimes being under, it is safer to make them all too small before heat-treatment. An oversize hole is much more difficult to deal with than one which is undersize.

HARDENED MATERIAL

Producing holes in hardened steel is a distasteful job which is, nonetheless, frequently necessary in tool-and-die repair work as well as in machine maintenance. A number of suggestions for methods to make this task somewhat easier and more satisfying will be given. It must be understood that no hard-and-fast rules can be made. The type and condition of tools used, power and condition of machine and work-holding device, and most of all, the type, hardness, and grain structure of the material to be worked all affect the ease and accuracy which are obtainable. Some experimenting, if at all possible, is definitely to be recommended.

To drill hardened material, it may be spot-annealed. If the material is thick, it may be necessary to drill progressively, annealing when the drill begins to work into hard material again. There are a number of types of drills available commercially which will drill hardened steel without annealing, with varying degrees of success. The best known are the three fluted or triangular hard-steel drills. These alternately locally-anneal a portion of the material and remove it as it softens. If properly ground and used, they are quite successful. If the material is not too hard, solid carbide drills may do the trick. These are normally fluteless, ground with a two-lip chisel cutting point. For thin stock, an old gunsmiths' dodge is useful. This involves deliberately burning up a carbon-steel (or HSS) drill. A punch mark or similar indentation is made on the work first. Then a drill is applied to the work at the highest possible speed, without coolant, and with heavy pressure. The drill is held against the work until the work softens enough to allow cutting. Every few seconds the drill is withdrawn from the work to allow it to cool in the air and to blow chips from the hole. When the drill is returned to the hole, force is applied quickly and heavily to cause the drill to dig in and keep cutting. Heavy pressure is an absolute necessity; the drill must be kept cutting while in the work. If pressure is relaxed, the hole will glaze and restarting the cut will be next to impossible. As can be imagined, this ruins the drill. For work over ¼ inch in thickness, more than one drill will be consumed. This explains why gunsmiths use carbon-steel drills for this type operation: they are cheaper than HSS. The burnt-up end of the drill may be removed, however, and the drill reground, and returned to service. The drill should be less than the desired final hole size. The drilling action will anneal sufficient material around the hole to permit sizing with a reamer.

TAPPING

Hardened work may be tapped if the soft portion around the hole, as produced by the drilling, is deep enough to accommodate the thread depth. If not, it should be torch-annealed. In either case, it is recommended that the tap be strengthened by shortening it, as in Fig 8. This reduces the twisting between the cutting edges and the driving square, and the ability to 'feel' hard spots in the work is improved. Such shortened taps will take far greater strains than full-length taps. Where possible, fluteless chip-driver "gun" taps should be used due to their greater cross-sectional area and correspondingly greater strength. When tapping through holes in case-hardened material, be cautious when the cutting edges of the tap approach the far side. The tap will operate readily enough within the soft interior of the material, but it may hit the harder stock at the far side of the work unexpectedly. A broken tap is the inevitable result; and until you have removed a broken tap from a piece of hardened steel you have not tried anything. Heavy chamfering of the hole prior to tapping is advisable and will reduce the danger of tap-breakage at the break-through.

LOWER ADMINISTRATIVE COSTS . . .

CLOSER SUPERVISION . . .

FASTER SCHEDULING . . .

PAST-PERFORMANCE RECORD . . .

RECURRING-DEFECTS RECORD, WITH . . .

New multiple-sampling plan for quality control

RICHARD M JACOBS, Commercial Electronic Products Section, RADIO CORPORATION OF AMERICA, CAMDEN, N J

One of the most important dollar-saving methods available to industry today is the use of statistical quality control in the inspection phase of manufacturing. A method for using the less expensive multiple-sampling inspection technique at a lower administrative cost than heretofore has been developed.

Quality Control, as defined by many eminent leaders in the field, is "the gathering, recording and analyzing of the data from manufacturing processes or laboratory experiments. Statistical Quality Control (SQC) also includes the corrective action follow-up derived from this analysis." One of the primary mainstays of SQC is the inspection function, as it is the inspector who gathers and records the data for the analyst.

Inspection and recording costs can be reduced without jeopardizing quality of product. Statisticians and mathematicians have developed techniques of single-, double-, and multiple-sampling plans which have effectively reduced inspection costs. The most popular source of these plans today is Military Standard 105. Now we add to these cost-saving techniques a low-cost administrative and recording method.

SAMPLING PLANS

Examine sampling methods that have been popular in recent years:

1) Constant percentage sample—Has proven disastrous to many a production activity.

2) Constant sample size—A much sounder method, yet not as sophisticated as,

3) Single sampling, based on a desired quality assurance and lot size, as well as the process average for the previous several lots. A random sample is taken from a lot and a decision is reached to reject or accept based on the number of defectives found in that sample.

4) Double sampling—Also statistically sound and based on lot size, desired quality level, and process average. Double sampling is the term applied to the procedure of taking a single random sample, then if this first sample from the lot isn't exceptionally good or extremely bad, a second random sample is taken from the lot—at which time the decision to accept or reject is made. It is possible to accept or reject on the first sample but on questionable lots a third decision is possible: To take another sample.

5) Sequential sampling and multiple sampling are terms which are used by most people interchangeably. The basic difference between the two is that multiple sampling has five, six, or seven steps similar to the first sample stage of a double-sampling plan. Specifically, multiple sampling is a truncated group sequential plan. The sequence is ended by an accept or reject decision on the final sample. The term sequential sampling applies to a series of steps for either group or individual sampling but doesn't have to stop until all units in the lot have been inspected. Sequential plans can also be truncated at an earlier point.

Finally, a decision must be made to accept or reject as there are no more units from which to take another sample. These plans are also statistically sound and are based on process average, desired quality level, and lot size. Figure 1 shows the graphical representations of the plans outlined.

Sample sizes . . . The single sample takes a large number of units at one time. Double sampling takes a smaller quantity on the first sample and a larger quantity on the second sample, with the total always greater than the single sample size. Sequential plans use much smaller sample sizes and are constant for all samples but may continue through the entire lot size if a decision isn't reached or if the plan is not truncated. Multiple-sampling also uses

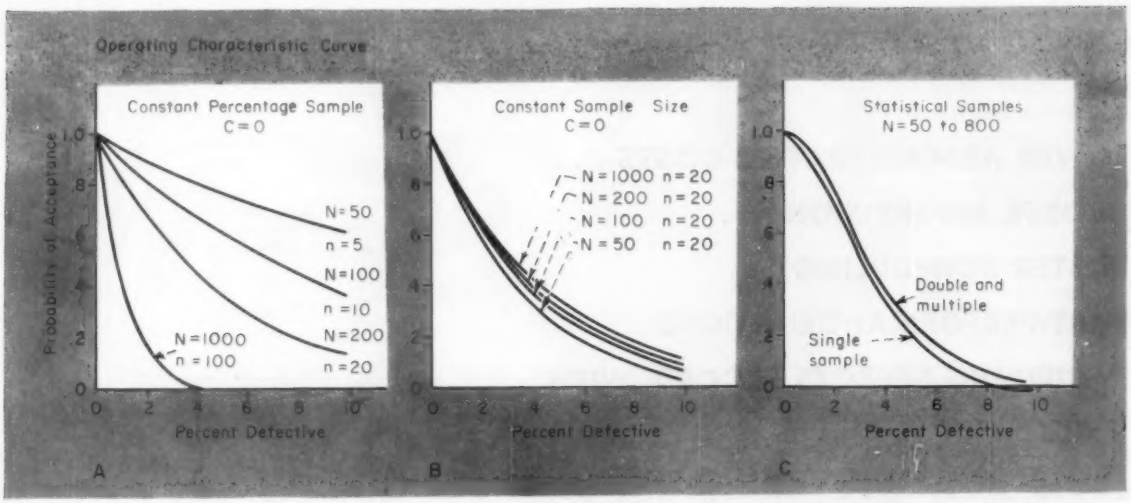


FIG. 1—Typical sampling plans

smaller sample sizes than single and double sampling and the size remains constant for all steps. However, the total possible is seldom more than than the single sample and the double sample plan total is rarely reached.

In double sampling a decision to reject or accept can be made after the first sample. On questionable lots rejection can be made before the entire sample is inspected. Acceptance of questionable quality lots must await completion of the inspection operation of the second sample. In multiple sampling, decisions are reached, on the average, at the end of the third step. Therefore, it can be shown that multiple sampling will, on the average, require inspection of fewer units.

ADMINISTRATIVE PROBLEMS

Inspection sampling methods can, in the long run, save money without reducing quality levels by the simple factor of reducing the number inspected. Some other problems confronting the Quality Control Manager or Engineer trying to adopt these cost-saving techniques in his department are:

A) Space requirements for each type of sampling plan, and the space required varies considerably.

B) Materials handling requirements must be evaluated relative to the contemplated sampling plan.

C) Temporary storage while lengthy inspections or investigations are conducted.

D) Incentive pay for inspectors.

E) Packaging after inspection.

Each of these problems has many solutions and each must be solved in relation to the sampling plan contemplated. Thus, compare the administrative and inspection costs of inspecting the same characteristics by:

a) Inspecting all of the units in the lot.

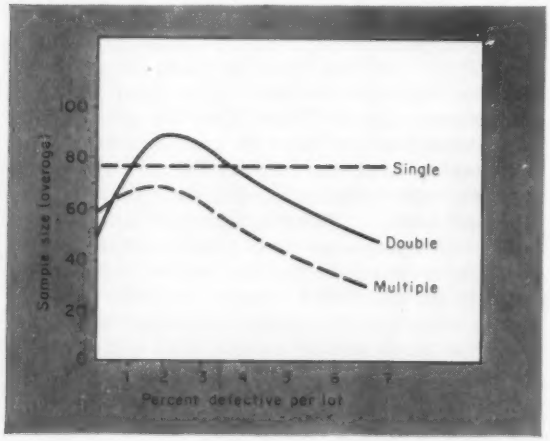
b) Taking statistically sound samples based on a single sampling plan.

c) A series of samples based on a double sampling plan.

d) A series of samples based on a multiple sampling plan.

To indicate the relative costs of inspection assume that the plan under consideration is AQL (Acceptable Quality Level) of 0.65%, lot sizes 500 to 800 units, and from MIL Std 105. Table I has been abstracted from this standard.

FIG. 2—How many pieces?



The average number of units inspected for a lot having 0.5% defectives for single sampling is 75, double sampling calls for 70 units, multiple sampling for 63 units. For a lot being a 1.0% defective, single samples are still 75 units but double-sampling will average 80 units while multiple-sampling people will inspect only 66 units, average. If the lot is extremely good (Fig. 2), less than 0.3% defective, double sampling will actually require, on the average, fewer units inspected than multiple sampling. Lots more defective than 0.3% will have considerably less units inspected by multiple sampling.

The number of units inspected for a lot of 501 to

800 units using the single sample requires inspection of 75 units, double sampling requires no more than an 85 unit average, and multiple sampling plans require no more than a 68 unit average. Hence, for the example presented, inspection costs for multiple-sampling are only 13% of the all-unit inspection cost. Double and single sampling are correspondingly greater.

TABLE I —Standard sample size

Letter J Lot Size 501 to 800		Level II		Mil Std. 105A AQL 0.65%	
Type of Sampling	Sample No.	Sample Size	Total Sample	Quantity Acc	Quantity Rejected
Single	1st	75	75	1	2
Double	1st	50	50	0	3
	2nd	100	150	2	3
Multiple	1st	20	20	*	2
	2nd	20	40	*	2
	3rd	20	60	0	2
	4th	20	80	1	3
	5th	20	100	1	3
	6th	20	120	1	3
	7th	20	140	2	3

** Acceptance not permitted until the 3rd sample has been inspected*

TABLE II —Elements of Quality Control

	FOR EACH CHARACTERISTIC			
ITEM RECORDED	A	B	C	D
Purchase order No.	X	X	X	X
Total ordered	X	X	X	X
Total rec'd to date	X	X	X	X
Total rec'd this lot	X	X	X	X
Job number	X	X	X	X
Drawing number	X	X	X	X
Date received	X	X	X	X
Purchase order date	X	X	X	X
Date of inspection	X	X	X	X
Number accepted	X	X	X	X
Number rejected	X	X	X	X
Total number defective	X	X	X	X
Type of defects found	X	X	X	X
Number inspected total		X	X	X
Sampling plan used		X	X	X
First sample size			X	X
Number defective 1st sample			X	X

A—All-unit inspection; B—Single sampling;

C—Double sampling; D—Multiple sampling

ADMINISTRATIVE COSTS

In the inspection operation where all units are inspected, it is general practice to maintain a record of the number inspected, usually the same as the received quantity. The number and type of each defect, the total number of defective units, and the total number of defects found, are also recorded These totals are not necessarily the same, as more than one defect can be found on a unit. *Yet only one defect makes a unit defective.* The date of receipt, date of inspection, and the final decision as to rejection or acceptance are usually recorded. Rejection may take a number of forms:

a) Reject and return to manufacturer

b) Reject and rework at customer's cost or at manufacturer's cost

c) Reject and scrap

d) Reject the part of the lot not immediately required to maintain production schedules (minor error).

Acceptance may also be with or without reservations, with complaints made most often on minor characteristics that do not affect operation of the unit. Also recorded is the total number of units ordered, received, accepted, and rejected, plus the various causes for rejection on a cumulative basis for each job number, each vendor, etc. Table II, column A, shows an abbreviated list of these elements.

In single sampling the inspector is advised of the sampling plan to be used by either a code designation or is given a specific sampling plan for each characteristic of each part number that he is to inspect. He must record, in addition to the data required for all unit inspection (Table II, Col A), applicable plan designation and the number of units inspected for each characteristic (Table II, Column B).

Double-sample procedures require the same essential information as single sampling, and, in addition, the first sample size and the number of defects found for each characteristic. Table II column C indicates this addition. Multiple-sampling requires no more information than the double-sampling procedure as shown in Table II Column D.

Indirect cost of sampling . . . The supervisor in an operation using all-unit inspection has a large staff; he spends little time with each individual. The decision to accept or reject is on a unit by unit basis rather than acceptance or rejection of the lot based on a sample of the lot. The supervisor has more responsibility in sampling inspection than in an all-unit inspection, consequently he spends more time with each individual inspector in assisting and advising him in reaching a decision of lot acceptance or rejection. He must also guard against laxness on the part of the inspector who wants to get on with another more enjoyable inspection job. The supervisor needs a smaller staff in sampling inspection programs to handle the same quantity of material received.

INSPECTION INSTRUCTIONS

In all sampling plans, someone must tell the inspector how to inspect each unit and what equipment to use. Defects must be classified either formally or informally to permit the inspector or foreman to reach a decision on the acceptability of the lot. It is becoming more common to have a formal method of classifying defects as a result of the increased influence of military purchasing policies on our economy. Most military contracts reference a specification which requires the manufacturers to de-

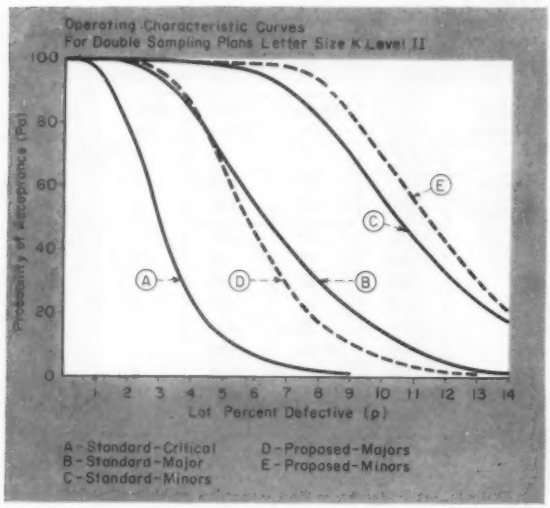


FIG. 3—Probability curves

vise such a classification system. Once this is done the manufacturer must then assign a sampling plan to each classification by defining the Acceptable Quality Level (AQL) for each class of defects for their products. In small organizations it is not uncommon to find one individual assigning AQL's to each class, whereas in large plants there may be many groups and people involved in the same activity. In a one-man operation standard rules are developed which are followed but eventually variations creep in. These classes, and AQL assignments, may eventually vary considerably. This practice develops confusion on the part of vendors, inspectors and other affected personnel. It is therefore to the advantage of everyone involved, especially in large organizations, to standardize form, content, defect, class definitions, and AQL assignments. With this in mind, a form was developed, primarily for use in receiving inspection but with the proper title changes it becomes useful in all manufacturing operation.

Development of explicit inspection instructions resulted, in part, because the estimate of a lot's acceptability is subject to more error as the sample size decreases. It is therefore necessary to depend upon the decisions reached using a small, precisely inspected, sample. It is expected that these instructions will improve the precision of the inspection function.

Purchase Order . . . The inspection activity begins with the receipt of the material plus a copy of the Purchase order as identification. It is desirable to provide, at the beginning of the inspection operation, the needed inspection information. Others interested in the product should also be aware of the basic instructions the inspector receives. The Purchase Order as developed accomplishes this result. The PO was crowded enough with information, hence a code was developed to transmit, within the organization, the needed data. Each basic component group was listed and evaluated in a general manner for the assignment of an Inspection Code Letter. These code letters are placed on the Purchase Order by the Purchasing Department when the order is written.

In this manner the requisitioner, inspector, buyer, and all other receipients of Purchase Order copies will know the inspection code. It is also placed on the Receiving Report for the Inspector. As shipments are received they are listed at the bottom and the inspector can see at a glance the results of previous inspections for the PO even though he may not have inspected the lot.

INSPECTION CODE

Component groups were assigned letter designations showing the cognizant inspection group and the inspection code AQL letter. The code was simple and was not intended for secrecy, but to permit the company to change the AQL value or the details of the sampling plan without changing procedure or instructions to the many groups involved.

The first letter indicates the cognizant inspection group, either mechanical or electrical (M or E). Our inspectors are in the two major groupings for administrative organization reasons. It also permits ease in assigning personnel to equipment. This group assignment is not restrictive; it serves only to indicate responsibility for proper inspection to a particular group.

The second letters are one of the first seven letters of the alphabet (A, B, C, etc. to G and the letter Z). Table III indicates what these letters mean in terms of AQL values.

The letter Z is used for components that require special handling on sampling methods. Acceptable quality levels are selected to suit current requirements of assembly and test techniques. For some products the cost of inspection using higher quality levels is not economical because defective units can be detected in the assembly and test operations at a lower cost than in incoming inspection. These levels were selected by an economic and quality evaluation.

In the past, classification of defects resulted in an AQL assignment for each characteristic. However, the cost of selecting different samples, inspecting different quantities for different characteristics, and recording the results for each characteristic as outlined (Table II) was overwhelming. Hence possibili-

TABLE III—AQL code

Inspection Code	AQL
A	0.4%
B	1.0
C	1.5
D	2.5
E	4.0
F	6.5
G	10.0
Z	Special Instructions

These AQL correspond to the sampling plan AQL's of MIL STD 105.

TABLE IV—Multiple-sample plan D

Lot Size	Sample Size	SAMPLE NUMBER 1 TS	A	R	2 TS	A	R	3 TS	A	R	4 TS	A	R	5 TS	A	R	6 TS	A	R	7 TS	A	R
0-65	10	10	0	1																		
66-180	7	21	0	2	28	1	3	35	2	4	42	3	4									
181-300	10	20	0	3	30	1	3	40	1	4	50	2	4	60	2	4	70	4	5			
301-500	14	28	0	3	42	1	4	56	3	5	70	3	5	84	3	5	98	4	5			
501-800	20	40	1	4	60	2	5	80	3	6	100	5	7	120	6	8	140	7	8			
801-1300	30	30	0	4	60	2	5	90	3	8	120	4	9	150	6	10	180	8	12	210	11	12
1301-3200	40	40	0	4	80	2	7	120	5	9	160	7	11	200	9	13	240	11	15	280	15	16
3201-8000	50	50	0	5	100	3	8	150	5	11	200	8	13	250	10	15	300	13	17	350	18	19
over 8001	75	75	1		150	4	10	225	8	14	300	12	18	375	15	21	450	18	25	525	24	25

Instructions for using sampling plan

Sample Size—each succeeding sample is this size
TS—Total Sample Taken
A—At this number of defects or Below—ACCEPT the lot. (Acceptance Number)
R—At this number of defects or ABOVE—REJECT the lot. (Rejection Number)
If the number of defects falls between A and R—take another sample

Samples MUST be extracted in as near equal numbers as possible from all boxes or cartons in each shipment making up the lot. When the box is packed in layers, samples must be taken equally from each layer.

ties for reducing these costs without sacrificing quality or altering producer and consumer risks were studied.

Multiple sampling proposal . . . Analysis of typical defect classifications on many common components revealed that, in general, the analyst assigned the critical defects to the lowest AQL plan for that part. Then the majors and minors were assigned not the next higher AQL but the second higher AQL and the fourth higher AQL. For example: *Criticals* were assigned 1.0% AQL, *Majors* 2.5% AQL and *Minors* 6.5% AQL. This was not a hard and fast rule but the pattern was significant.

Standard weighting factors can be employed with little or no effect on the quality but a significant reduction in inspection costs. If *one critical defect* is assigned to each rejection or acceptance number as defined in Mil Std 105, *two major defects* to each rejection or acceptance number, *four minor defects* or a combination of one major and two minor defects to each rejection and acceptance number, using the AQL usually assigned to the critical defects, we would not alter risks or quality levels to any great extent.

In any plan, if the acceptance number in the applicable plan is "1" and the rejection number "3," we would be in a position to accept the lot if there were one critical defect, or three major or seven minor defects or a combination of one major and two minors. It is almost obvious that this suggested weighting ratio allows more minor defects than we would normally like. However, customarily, minor defects are accepted or waived or corrected at a later date because production must continue, and a minor defect should be considered minor in importance to manufacturing schedule if it can be fixed later or if it doesn't affect product quality. The cost of sorting later, if it becomes necessary, should be more than offset by the savings in the incoming inspection function.

This weighting factor permits the use of one sampling plan per component and recording the result, by adding the defects in their proportionate value of rejection or acceptance number, on the shipment inspection report. Last but not least, it allows the manager to more readily stabilize his inspection load as the size of samples per lot is not indeterminate. Samples are more finite, and better scheduling provides further cost saving. Thus the ratio of 1 critical, 2 majors, or 4 minors for each rejection or acceptance number allowed was evaluated and found economically feasible. In addition to reducing the administrative cost of using these inspection sampling techniques, a number of other benefits are obtained:

Past performance record . . . Each part may be ordered from many different vendors. To direct purchases to the higher quality vendors, a *Past Performance Record* was developed to record the performance of each vendor for each part supplied. This form is required for each part purchased. Vital information is recorded and the cross-reference number, for more detail, is used in the form of the purchase order number-receiving sheet number. This number refers to the back of the Receiving Report, an Inspection Report. The inspector uses this form to record the detailed inspection results.

Recurring defects record . . . This Past Performance Record is filled out by clerical personnel along with the *Recurring Defects Record* from the Inspection Report, which permits the Inspection Department to feed to Quality Engineering specific

data for corrective action by the vendor or by design engineering, whichever group can effectively reduce the cause of defect recurrence. The beauty of this form is that defects found by the assembly, test or service departments can also be recorded. If the defect occurs too frequently, action must be taken by the *Reject Control* supervisor who coordinates the corrective actions taken by all interested parties.

In summary then, the Inspector has at his disposal in one folder the following:

a) Blueprint; b) Inspection instructions; c) Purchasing Agreement (Purchase Order); d) Receiving quantity; e) Proper sampling plan; f) Vendor history; g) Recurring Defects Record for each part; h) Latest 3 months of Inspection Reports.

This system can only pay for itself when inspection cost is held to a minimum. We can then take advantage of this saving to provide to other departments useful, accurate data on the vendor and on the component part to correct repetitive defects as they occur.

This system, although constantly modified for cost reduction purposes, has been successfully used in three major industries and in about 10 companies for the past five years. Some inspection services of the Government accept it as fulfilling the quality control requirements of incoming inspection operations.

The proposed system, utilizing the combined sampling plans for critical, major, and minor defects has the same degree of success for any combination of selected AQL values for the three classifications, as long as they are two steps apart.

A TYPICAL CASE

To justify the proposal we have selected a typical lot size of 1000 units, level II of Mil-Std-105A (Code letter K) as the basis for discussion. Using Molina's* tables, the Probability of accepting a lot with varying degrees of fraction defective was calculated for each of the plans discussed previously and illustrated in Figure 3.

*Poisson's Exponential Binomial Limit. E C Molina, C1947. D Van Nostrand Co, Inc 47p

For example: First sample size N_1—75
Second sample size N_2—150
AQL—1.0% Double sampling plan
First acceptance number—1
Second acceptance number—5

The Probability of accepting (P_a) a lot 1% defective (p) using a random sample is found by adding the probabilities (P) of each combination of occurrences:

P of 1 defect or less on first sample	0.8265
P of 2 defects on first sample times P of 3 defects or less on second	0.1240
P of 3 defects on first sample times P of 2 defects or less on second	0.0273
P of 4 defects on first sample times P of 1 defect or less on second	0.0035
P of 5 defects on first sample times P of 0 defects or less on second	0.0002
	0.9815

Curve A represents the standard 1.0% AQL Plan of Mil-Std-105A which in our hypothetical case is assigned to critical defects.

Curve B represents the standard 2.5% AQL Plan assigned for major defects.

Curve C represents Standard 6.5% AQL Plan assigned for minor defects.

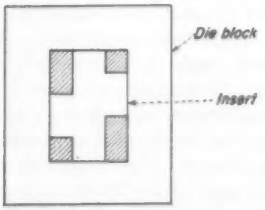
Curve D represents our proposed plan for majors when they are equal to one half a reject number.

Curve E represents our proposed plan for minor defects when they are equal to one quarter of a reject number.

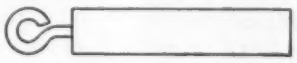
It can be seen that the proposed plan follows very closely those of the published standard plans and that even though our minor plan will accept defectives more readily it is generally in keeping with QC procedures of accepting minor defects when production will not be hampered and the operational aspects of the equipment will not be affected.

Diemakers Kinks

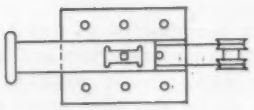
FEDERICO STRASSER

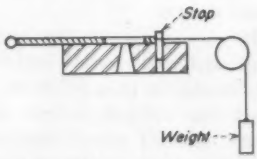


RECTANGULAR piercing openings can be provided easily by cutting a large rectangular opening in the die block, with walls slightly tapered, and press fitting a machined insert, and touching up the piercing openings to suit.

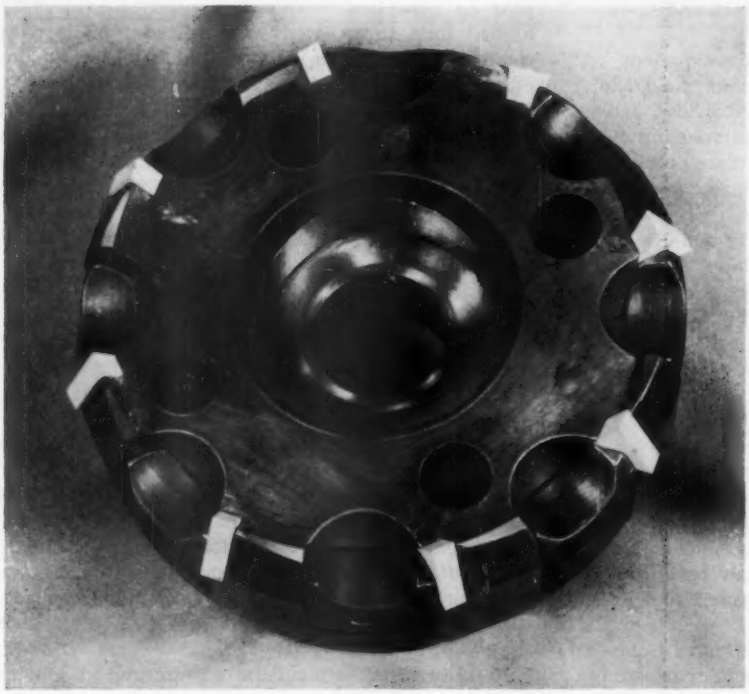


PRECISION FORMING of round tubes should be done with a mandrel fitted with a common file handle, never a ring handle. The latter is a source of danger to the operator's fingers if the mandrel rolls during the forming operation.





SLIDE FEEDS for second-operation dies must always be pushed against a stop, or otherwise accuracy of the operation is lost. To guard against improper operation, counterweight the slide so it will always contact the stop.



Martin-designed face mill . . . is special for ceramic cutting tips. Fitted with American Lava's Alsimag A614 tips, it is used to mill SAE 4130 steel at 500 sfpm, 0.004-in.-thick chip per tooth, and 0.093 in. depth of cut. Each tooth is held by an individual clamp and is backed up by a triangular support piece

Martin tests ceramic tools

Preliminary tests of ceramic cutters at The Martin Company add one more opinion to the growing volume of information on these new, and highly important, metalworking tools in production applications. Thus far Martin has not had the success reported by some other users (*AM*—Dec 3 '56, p113) but findings are encouraging

During the past year, The Martin Company has done only small scale work with ceramic cutting tools. However, Manufacturing Research and Development is working on one major item—a new toolpost holder which, it is hoped, will reduce vibration and provide a more rigid and solid cutting instrument.

Martin has found it possible to cut with ceramic tools experimentally almost any time and obtain good results. The major problem is application to production setups. This has not been truly successful. The basic cause seems to be excessive vibration in the cutting tool and in the toolpost holder. It is vibration that cannot be seen but can, usually, be felt. Thus, effort has been concentrated in developing a toolpost holder which will reduce vibration sufficiently to assure success in production jobs, as well as in the research and experimental work. Production operations must provide output; they do not permit the close control and watchfulness available in the laboratory.

Ceramics were tested at speeds from 100 sfpm up. Feeds were from 0.001 to 0.125 ipr. Materials cut included SAE 4130, SAE 4340, SAE 4340 + vanadium, and SAE 4335+vanadium, as well as a number of stainless steels. Ceramic materials were supplied by American Lava, Stupakoff, Adamas, Diamondite, and Sintox.

Tool life was very erratic. Under ideal conditions ceramics proved superior to carbide on hard materials—but only in laboratory tests. This was true generally—results were good in experimental work and bad in production applications.

Milling and face-milling experimentally, cutting high-tensile SAE 4340 steel at 520 sfpm, with 0.0015-in. feed and 0.100 in. depth of cut, resulted in short tool life and excessive tool breakage.

Most of the early tests with ceramics were conducted using Alsimag A614, supplied by American Lava Corp. Various shapes were submitted as cutting tools. These shapes have been narrowed to tips which are held in mechanical holders and indexed like tungsten carbide "throw aways". Most tests with

Martin tests ceramic tools . . .

this material have been made using 3/16 and ¼-in.-thick wafers.

Alsimag A652, as a more recent development, is proving to be much more successful than the earlier grades. Also, representatives from American Lava are working very closely with Manufacturing Research and Development at Martin and are preparing tips having greater thickness to minimize transverse rupture.

Adamas OX-12 also appears to have definite possibilities. Preliminary tests were made without a sufficient quantity of tips available for a conclusive result, but the tests were encouraging. This material was supplied in ½ in. squares and ⅜-in.-dia wafers 3/16 in. thick. OX-12 was tested on a production job on a No. 3A Warner & Swasey turret lathe cutting mild steel at 900 sfpm speed and 0.012 ipr feed.

Tests were made with a toolholder having a 15° lead angle. It was found to be very important to stop the feed before the tool reached the point where the previous cut stopped. The sudden shock of picking up a double load, if only for a few revolutions, was very detrimental and usually caused tool failure.

Square inserts are better than triangular because the 90° corner is better able to withstand overloading than the 60° corner on the triangular inserts. This effect is equally true on other ceramics too. A 1/16 in. nose radius on the tip was also found necessary for satisfactory results.

At present, no specific make of ceramic can be selected as definitely most satisfactory. All grades appear to give best results at speeds considerably higher than those used with carbide. All grades require a larger nose radius than carbide and are most satisfactory with a 15° or greater lead angle.

Many of the problems which prevent more general use of ceramics in production work are found in the design of tips and holders. Also, it is possible that the machine tools designed for use with conventional carbides and high-speed steels do not provide the speed nor the "beef" necessary for successful ceramic cutting.

Holders definitely need attention. Sintox holders, for example, which take a tip ½ in. square by ⅝ in. long, are very subject to damage when the cutting edge fails. Most holders, generally, are designed for 3/16 or ¼-in.-thick wafers. Often, these wafers break so badly that they cannot be used when indexed to other cutting edges. It seems more practical to make wafers approximately ⅜ in. thick. Other problems are similar to those of mechanical holders for carbide. It is difficult to turn small-diameter work supported between centers. Often, mechanical holders are too bulky for satisfactory application to turret lathe tooling. For roughing cuts with heavy feeds, it appears that the bar-design insert is better than the wafer shape.

In spite of the difficulties encountered at Martin in the use of ceramics, engineers believe that by combining the good points of the various ceramic materials, and the toolholders, a much greater degree of success is just around the corner. Disregarding tool life, the productivity and surface quality resulting from ceramic cutting is outstanding.

Small plant solves material handling problem

"Material Handling" doesn't *have* to include elaborate equipment such as conveyors, transfer machines, and punched cards. In fact, it is only the larger, mass-production plants that can afford to think in these terms. A small plant must approach the problem on a much more modest basis. If, in addition, the plant is manufacturing a variety of products, flexibility will be a particularly important consideration.

This was the situation at the Danvern Division of Erickson Tool Co, Painesville, Ohio, where a number of plastic novelty items and steel parts are produced in a plant measuring 40 x 50 ft.

The company was faced with the problem of handling cartons of plastic blanks, cartons and tote boxes of plastic parts in process, 50-gal. oil drums, bar stock from ⅜ to 6 in. in dia, and steel drums containing up to 1000 lb of semi-finished steel parts.

The solution was found in a single portable lift whose 100-lb capacity permits it to handle all normal loads in receiving, storage, production, and shipping. It also sees occasional service in maintenance activities and in the installation and relocation of productive machinery. A product of the Oster Manufacturing Co, the lift is elevated hydraulically and is moved by man-power.

Because of its small size, this equipment can perform its job in very confined areas. As a result, the company has been able to reduce aisle-width and devote more space to production and storage.

Round Table

Key-Man Bonus Plan

"This new bonus for foremen sounds great, Ed. It sure will be a help to have some extra money rolling in."

"Don't get too worked up about it, Al. They'll probably never get it off the ground."

"Why not? Don't tell me they've turned it down already. We just heard about it at the meeting last night."

"Well, it just doesn't make too much sense, Al. What's going to happen to the plant if all the foremen start pushing their men so they can collect a bonus? A lot of the foremen will just forget about keeping the equipment in good shape and go for high output. I've seen more than one company ruined by the idea that the only thing that counts is production out the door."

"Oh, give Management more credit than that, Ed. If the thing's going to work at all, it has to be set up on a fair basis. It can't be based on production alone, and they know it. I imagine they'll work out some kind of formula that will take into consideration a lot of factors."

"A lot of factors is right, Al. Look; if Harrison has a tough time judging his foremen, what chance has a formula? You can't put initiative, common sense, ability to handle people, and foresight into a formula. But those are only a few things a good foreman has to demonstrate."

"If Harrison can judge a foreman, he can write down what he thinks, Ed."

"But you can't put an evaluation on what Harrison thinks, Al. Not so's you can work out a rating. It's easy to judge straight production, but you can't measure a foreman's ability just by a few vague ideas Harrison—or any other supervisor—has."

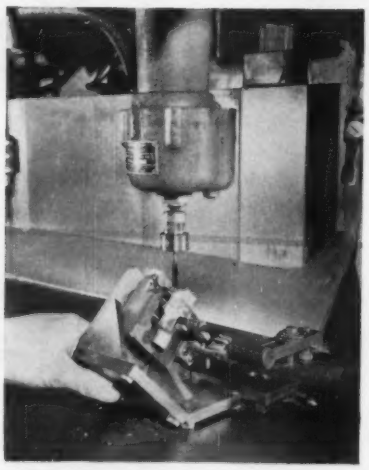
"You may be surprised, Ed. They can give personality tests to people now, and they come up with top-notch results. Maybe they can also judge a foreman, too."

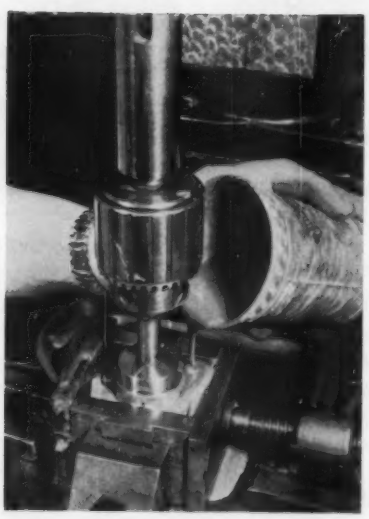
***CAN FOREMEN** be put on a fair bonus system that will spur production but not let them fall down on some of the less graphic parts of their jobs? Your ideas on the subject may help guide others. Discussions of earlier topics start on page 196.*

SHOP SHOTS

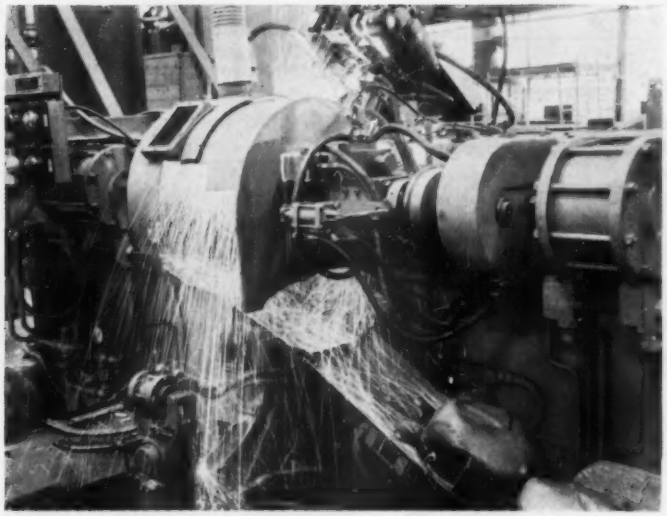
Vacuum chuck at Martin Aircraft holds contoured aluminum wing skins when they're trimmed. Chuck is really a free fixture with only a vacuum-line connection, and is made of glass-fiber laminate. Pressure of 18 psi exerted through network of grooves on fixture face will hold skin sections up to 0.08 in. thick. Production is for *Matador* missile. *Martin Aircraft Co, Baltimore, Md*

Drillpress mills chamfers at International Harvester's Chicago tractor works to reduce stress concentrations at edges of internal splines. Work is held on hand-controlled sliding plate, which positions it on table of 14-in. Delta drill. Depth is set by stop, and controlled to limit by foot pedal. Simple setup for short runs saves expensive mill or grinder time. *Rockwell Mfg Co, Pittsburgh*

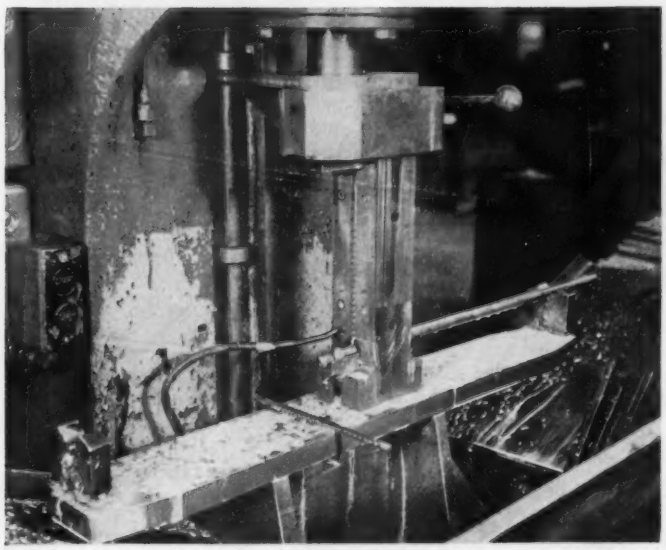




Plastic tooling at Smith Welding Equipment Corp, Milwaukee, does the same job as vise jaws, milling fixtures, and drill chucks at 15% of the cost. Nesting fixtures are made by pouring Rezolin Toolplastic around sample part, then making fixture with quick-acting clamps. Plastic hardens overnight without heat or pressure. Some have lasted for 10,000 parts without wear. *Bakelite Div, Union Carbide & Carbon Corp, New York*

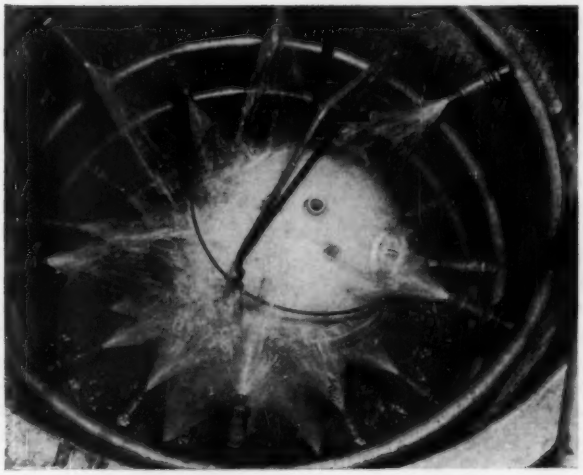


CO_2 welding at Kelvinator is done on automatic machine at rate of 100 refrigerator-compressor shells per hr. Unit places work, slides shield around it, then rotates shell under stationary welding head; finally ejects finished work. Spatter is reduced sharply by feeding gas through re-routed copper tubing instead of through head nozzle. *American Motors Corp, Detroit, Mich*

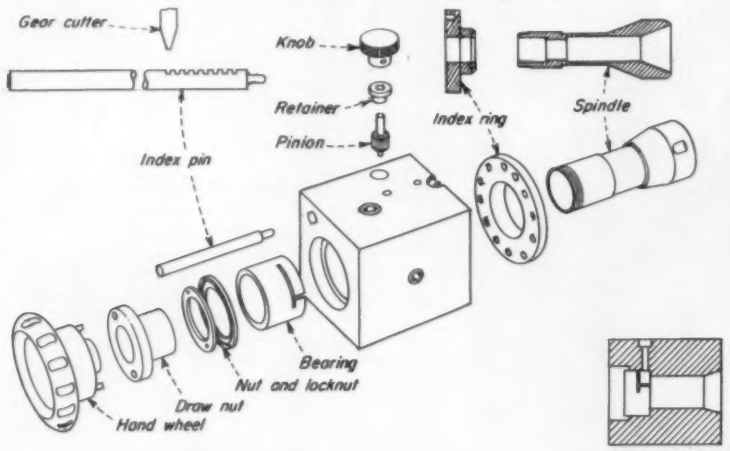


Broach guides at Pennsylvania Lawn Mower last twice as long because the guide column can be indexed 180° and used a second time. Work is a reel shaft, which has a longitudinal slot that must be squared off at the end. Push broach works until guide has become slightly worn, then the square column is indexed. *Pennsylvania Lawn Mower Div, American Chain & Cable Co, Exeter, Pa*

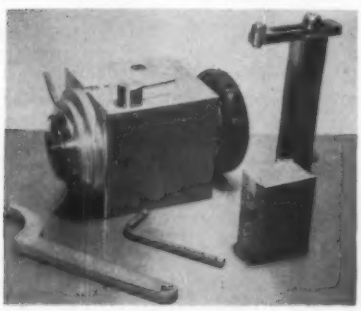
Shower bath at Martin Aircraft cleans off pressure tanks for Project Vanguard (earth satellite). Tanks are corrosion-resistant steel, heated to 970 F, and must be quenched. Buoyancy prevents submerging tank, so special spray unit was made to cool tank after heat-treatment. Tanks will carry fuel for three-stage rocket that will launch satellite. *Martin Aircraft Co, Baltimore*

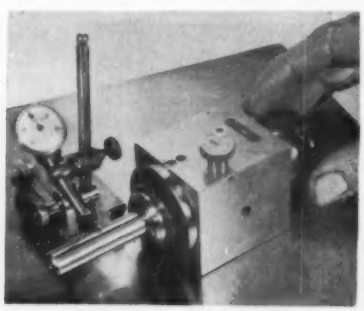


Practical Ideas . . .



Sectional View





Precision Index Block Grips With Standard Collets

When a toolmaker needs an index head to help machine a part, he may also wish for a head that would be easy to handle. Not only is an index head heavy to move around, but there may be times when a setup has to be broken up to make room for it.

The index block illustrated was designed for the prime purpose of doing simple indexing without the standard head. It can be held in a vise, strapped to a machine table, or used on the magnetic chuck of a surface grinder.

Mounted on its own angle plate, it is a convenient indexing holder for grinding the cutting edges of an end mill, or for drilling parts at any angle.

We have made this block in two sizes. The smaller employs standard ½-in. collets, and the larger 1-in. collets. The body of the smaller is a 2x2x2¼-in. CR steel block. It is carefully centered in a lathe chuck and bored to take the spindle, brass bearing, nut, and locknut.

The counterbore in the back end is sufficiently deep to permit a collet drawnut to be seated within outside dimensional limits. Thus, when the handwheel is removed, the back end can be used as the base.

A 1/32-in. slit in the brass bearing provides a means of locking the spindle at any desired location. A socket-head capscrew through the side of the block supplies the pressure on the bearing at this point.

The indexing ring has a snug fit on the spindle and is secured by four small setscrews. Twelve indexing holes are drilled on the back face of the ring in a circle to meet the index pin. The periphery of the ring is marked off in graduations for settings other than the indexing holes.

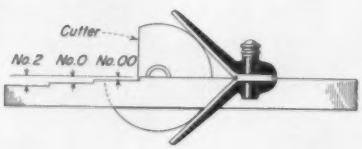
The index pin is engaged or retracted by a 12-tooth, 48 pitch-pinion meshed with a rack on the side of the index pin. A small knurled knob on the pinion shaft provides a means of engaging the pin from the side of the block.

Fiber is used for making the handwheel because of its fairly light weight and durability. The wheel is screwed onto a steel hub. Two drive pins pressed into the hub match the holes in the drawnut. This provides the operator with a quick method of coupling or uncoupling the handwheel as the job demands.

We have added a drilling attachment to the larger block, together with a spacer block, enabling us to drill holes up to and including a 3-in. radius.

While there is some time involved in making one of these blocks, the time saved and convenience in using it makes the effort worthwhile.

Karl Haller, Millington, NJ



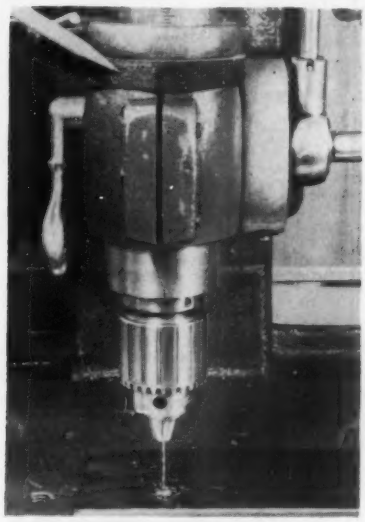
Three-In-One Gage Made From Altered Scale

A machinist's center gage with the scale specially ground makes a good tool for checking the step ground in circular form tools. The scale is ground with three steps.

The first step is 0.250-in. deep for gaging 3-in.-dia cutters for use on Brown and Sharpe No. 2 machines. The second step is 0.155-in. deep for 2¼-in.-dia cutters for the No. 0 machines. The last step, which is for 1¾-in.-dia cutters on the 00 machines, is 0.125 in. deep.

This provides a handy and inexpensive gage to check the depth of the step in relation to the centerline of the cutter. It will reveal a hook or other defect in the grind.

Buckley Sullivan, Cleveland, Ohio



Rubber Bumper Prevents Breakage of Small Drills

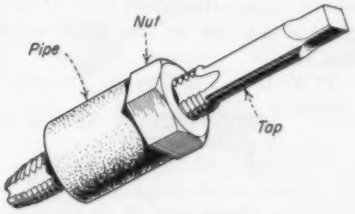
Small wire gage twist drills are easily broken when the point of the drill penetrates through the work. This is caused by the sudden removal of end thrust as the point breaks through. To control the feed properly at this critical instant is difficult, and on production work small drills will often be broken this way.

To help this situation, I have placed a thick sponge-rubber washer around the quill between the top of the quill support and the adjustable stop collar.

The stop collar is adjusted and locked in a position where it will bear on the rubber washer before the drill point begins to penetrate the work. The rubber washer will, in addition to warning the operator that the drill is almost through, take up backlash between the quill and the feed pinion.

Small-drill breakage has been practically eliminated in our shop since we began using this simple arrangement.

H J Gerber, Stillwater, Oklahoma



Tap Extracts Blind Hole Bushing

The ways must be many to pull a bushing from a blind hole, but the method we use is standard procedure in our shop now because it is quick and painless.

Although the scope of our work is wide and varied, our electromechanical work is primarily concerned with auto generators and fractional HP motors.

When a blind-hole bushing in a generator or motor bell-housing has to be renewed, the biggest job is usually that of getting the old bushing out. Here is where our method has made this job much simpler.

We select a tap large enough to give us a fairly good thread in the ID of the worn bushing. (A ⅝-in. tap, NF or NC, fits the bushing of a Delco-Remy generator perfectly.) When the proper tap has been found it is threaded into the bushing, as deep as permissible. A piece of pipe, about the same length as the bushing, and with an ID large enough to clear the bushing, is dropped over the top and centered.

A hex nut is placed on the extending threads on top of the pipe. The nut is then turned with a wrench while another wrench is used to hold back on the tap. As the nut continues to enter on the thread, the bushing is extracted from its hole until it drops out.

Stanley Clark, East Bradenton, Fla

Tape Assists in Drilling Plastic

When drilling plastic, place a small piece of cellophane or masking tape over the spot to be drilled. This gives the drill a good start, prevents it from slipping and marring the surface, and reduces surface burrs.

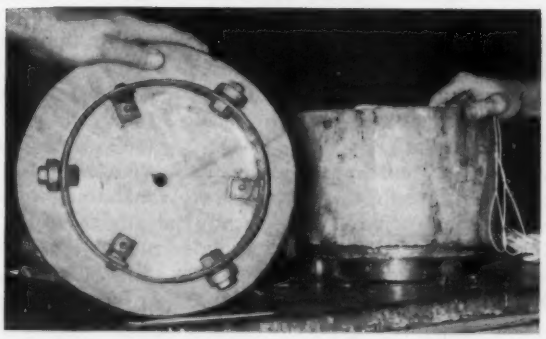
Harvey Muller, Danboro, Penna

Turntable For the Bench Is Useful Shop Helper

Besides manufacturing parts for and making repairs on farm equipment, we are often asked to rewind motors not readily replaceable, particularly when speed is a factor. To move the stator around on the bench is time consuming and in most instances awkward. It could also endanger the newly installed wiring.

We made the turntate shown in the photo to make manipulation easier. Though it was primarily intended for handling stators, it has been useful in many other operations. One of them is spray painting small parts, where the table makes it possible to turn parts without direct contact.

Three discarded free-running ball bearings were assembled 120° apart on a steel ring. Bolts, nuts, and spacer washers were used to secure them. Three short pieces of angle iron secured the ring to a wooden table top. A pin set in the work bench matches the center hole in the turntable. This is

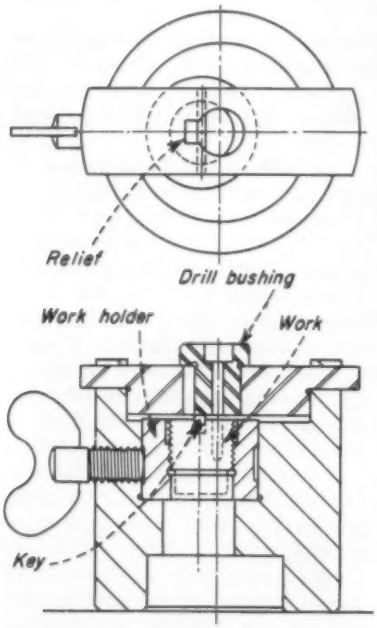


to prevent the table from wandering off the bench.

Should it be desired to use the table in welding, a steel plate should be placed on the wooden top with a sheet of asbestos sandwiched between.

Harry J Miller, Sarasota, Fla

Practical Ideas



Drill Jig Locates Holes Accurately

One job called for drilling 3/32-in. holes in adjusting screws for small diesel engines. Each hole had to be located at a specific distance with respect to the slot axis of the screw. The turning, threading, and slotting had previously been done in an automatic screw machine.

Since this was a production job, it was necessary to make a drill jig. The illustration shows the jig we developed. It is flexible enough to take many sizes of screws or similar parts.

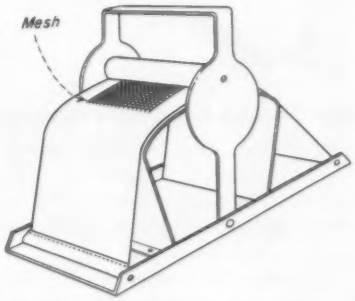
The portion of the cylindrical body that received the revolving work holder is bored eccentrically the same distance as required on the workpiece. The rim of the body is milled out to centrally locate the drill plate.

Turning and boring the drill plate is done in one setup to assure concentricity. The locating keys on the under side of the plate can be produced in either of two ways. One way is to leave enough metal to mill them out from the drill plate. Or keyways may be cut and keys inserted. We found the former method more practical because of the critical location of the keys. This distance must correspond with the eccentricity of the work holder. A small relief is cut into the drill-bushing hole to accommodate a screwdriver for locating the work.

To load the work into the jig the wingscrew is lightly tightened and the work screwed into the work holder. The wingscrew is then loosened and the drill plate is dropped into position. The work holder is revolved with a screwdriver until keys engage the slot in the work.

The wingscrew is now tightened and the drill-bushing inserted. The first part is then drilled. No adjustment is necessary on subsequent parts other than that of engaging the slot in the work with the key.

C Y Lee, Tai-Chung, Tai-wan, Formosa



Forming Tool Costs Less Than One Dollar

We had a short run of hydraulic strainers to produce. They were to be made from fine wire mesh with an ID of 5/16 in. and with seams overlapping.

To maintain uniformity, tooling of some sort was necessary for rolling the wire. This problem was easily solved with an economy cigarette-rolling machine. One of these is readily available at any tobacco store, and the cost is less than a dollar.

Rolling the wire with this tool is similar to rolling cigarettes, using a 5/16-in. dowel pin as a filler.

Diameters from ⅛-in. to ½-in. can be rolled from wire mesh or other light-gage material the same way. This is done by either shortening or lengthening the forming apron as required.

Donald Amison, Minneapolis, Minn

Winner No. 263

R B COURTNEY

won $25 in addition to regular payment for his idea:

SIMPLE EXPANDING MANDREL

in the issue of Nov. 19, 1956

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

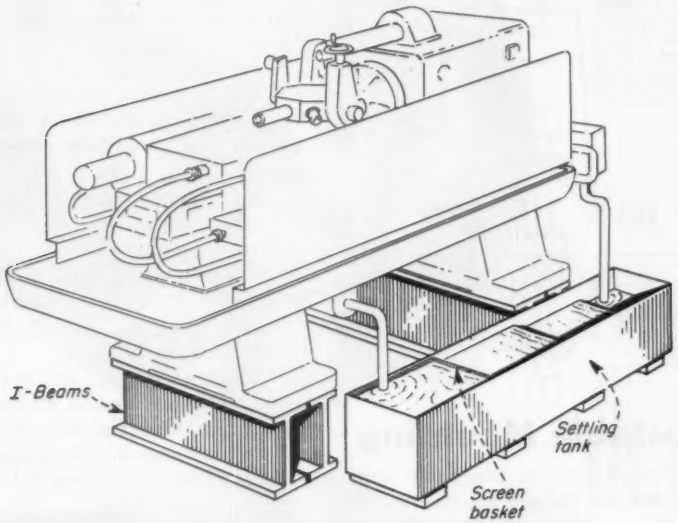
PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y



Settling Tanks Solve Fire Problem

Many firms that do machining operations on laminated plastic with steel inserts, such as timing gears and electrical components, have probably had the same problem we did. Fires would start in the chip pan, caused by the hot steel chips igniting the fabric and plastic shavings.

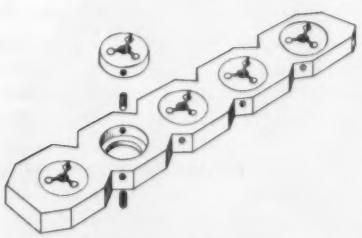
Although the chips are flooded with coolant, combustion still results, especially where carbide tools and light cuts for finishing permit high speeds, creating very hot chips.

To correct this problem we constructed a coolant settling tank divided into several compartments. We also raised the lathe on short lengths of 12-in. I-beams to provide the necessary gravity. Our aim was to flood the chips from the chip pan into the settling tank where they would be kept submerged.

The first compartment is fitted with a removable screen basket to facilitate cleaning, and is emptied twice each shift. When the coolant has reached the last compartment it is relatively free of steel and plastic particles, which are highly abrasive and rough on pumps.

So far, it appears we have controlled our flash fires, and, best of all, we have eliminated the fires which germinated during the night and cut loose about 3:00 AM in our trash containers.

Buckley Sullivan, Cleveland, Ohio



Five Button Dies In One Holder

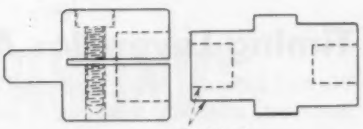
Five sizes of threads have become quite popular in our shop. The way we used to turn out these threads was the old standard and accepted method of dropping a die into a holder, adjusting it, and tightening the setscrews. Then, on the next size thread, the die would have to be changed again. This procedure would be repeated over and over, all the way down the line until the time wasted on changing dies rivaled that of the actual production time.

The holder shown has saved us a lot of time in this respect. It is bored to receive the five dies we use the most. Because they are permanently mounted, only one adjustment is necessary; the first one.

Although the tool can be used as a conventional die handle, it is best to at least start the threading in a lathe or drillpress, using a pad in the tailstock spindle or the drillpress table. The flat construction of the holder makes it very adaptable to this kind of backing, and it will produce a better thread.

I made this holder for small dies, but it can just as conveniently be made to hold dies of larger sizes, or a variation of button sizes.

Glen E Price, Caney, Kansas



Fixture Assures Concentricity

In our field of instrument work, bores and dia of workpieces require concentricity within extreme close tolerances. This is difficult to maintain when work must be reversed in a lathe. The fixture shown illustrates a method by which a finished dia can be held to rotate true with the lathe spindle, something a collet or chuck cannot be depended on to do.

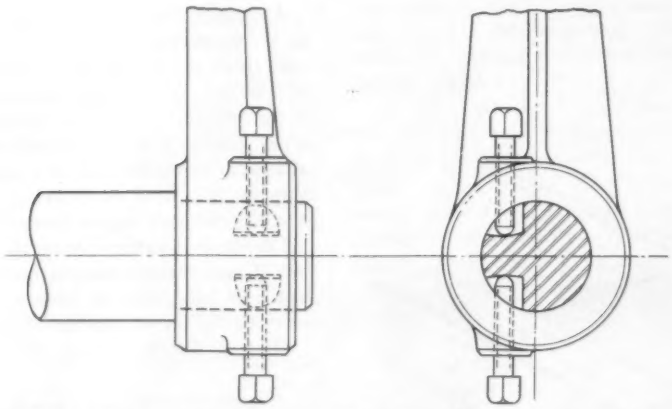
Material used for this holding fixture is usually brass of sufficient dia to provide a solid grip. If a substantial size collet is available, one end of the stock for the fixture is turned to suit that collet. The fixture may be made to work just as well in a chuck.

The part-holding bore is roughed out, depth is determined by the length and shape of the parts to be held. The fixture is slit as near through the center as possible. The hole for the clamping screw is a clearance fit above the slit and tapped below. It is then counterbored for a hollow-head capscrew.

Without tension on the screw, the fixture is again chucked or colleted, and finish-bored to the exact dia of the work. No distortion will result from the slight clamping pressure required to hold the work.

Bore can be reworked for subsequent larger dia parts.

Joseph Terran, Jackson Heights, N Y



Timing Lever Has Adjustable Mounting

We had difficulty in arriving at adjustment, and later holding it, on a timing lever used in an electromechanical measuring machine. This lever, of a light alloy and of considerable length, was affixed at one end of a shaft and rapidly oscillated in a 65° arc.

On the upper end of the lever was a contact sliding along a guideway on the machine frame. The movements of this contact had to be in exact synchronism with other movable machine elements and relative to the size of the work.

According to the different thicknesses of the workpieces, the contact had to be adjusted quickly and accurately to undergo its full stroke movement. To accomplish this the lever had to be adjustable for slightly different radial positions on the drive shaft.

For this reason the lever could not be keyed or by any other means positively fastened. The original method of mounting and adjusting the lever was to drive it on a slightly tapered shank of the shaft and lock it with a nut. This form of mounting resulted in delays, missynchronization, and many times damage to parts because of the lever loosening from vibration.

These troubles were effectively remedied by the modified lever and shaft arrangement shown. The new lever was provided with two vertical bosses directly in line, one on each side of the horizontal center line. The shaft was altered by remachining the shank to a light push fit in the parallel hole of the lever.

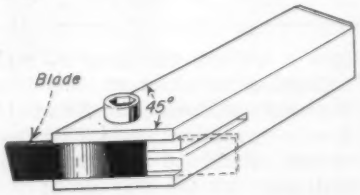
The bosses on the lever were drilled and tapped for fine-thread setscrews to provide fine gradation of adjustment to the lever.

At a point on the shank, transferred from the screw-holes in the lever, two identical slots were milled, producing a substantial lug between them.

When both screws are tightened the lever is positively retained on the shaft. To alter its radial setting, clockwise for example, it is only necessary to slacken bottom screw and tighten top screw a corresponding amount. Contrary adjustment will move the lever in a counter-clockwise direction.

This form of adjustable mounting can satisfactorily be applied to timing gears, cams, or eccentrics whose location must be found, or where settings must be quick and positive.

W M Halliday, Southport, England



Old Hacksaw Blades Never Die

Blanks cut from discarded HSS power hacksaw blades make excellent cutter bits for small lathe work. Holders for these blanks can be made to suit a variety of applications. Illustrated is a holder with the tool slot milled at 45° to the axis of the shank. This is to permit close-to-the-shoulder groove or thread cutting.

In machining the tool slot it is best to make the gripping edges slightly dovetailed for a secure hold on the tool. The clamping screw should be located as near the slot as practicable to obtain maximum clamping power.

Cutter-bit blanks are cut from the hacksaw blade with a "rubber wheel." The edges of the blades are ground to width and fitted snugly into the tool slot.

Forming, threading, and parting are some of the uses to which we have put this versatile and economical tool with much satisfaction.

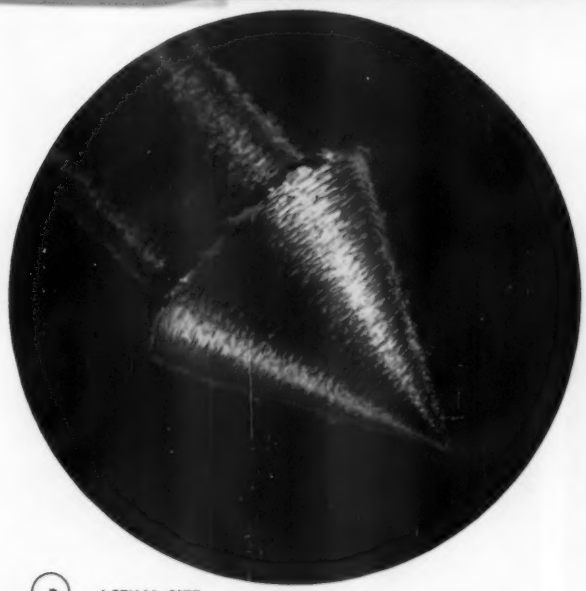
Karl Haller, Millington, NJ

Steel Plug Prevents Collapse of Pipe Fittings

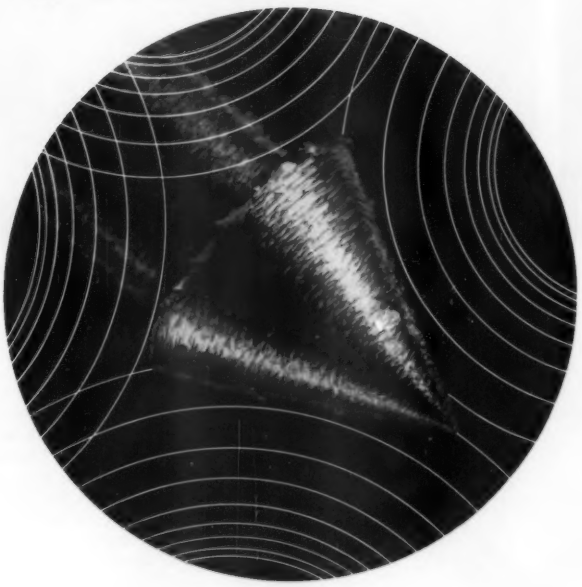
When damaged pipe fittings or nipples must be removed from pumps, engine cylinder jackets, or even when a fitting must be salvaged, the pressure of the wrench may collapse them. If corrosion has taken place it will add to this difficulty, making removal time-wasting in that a broken fitting may ruin the threads of the casting, and consequently will need reworking.

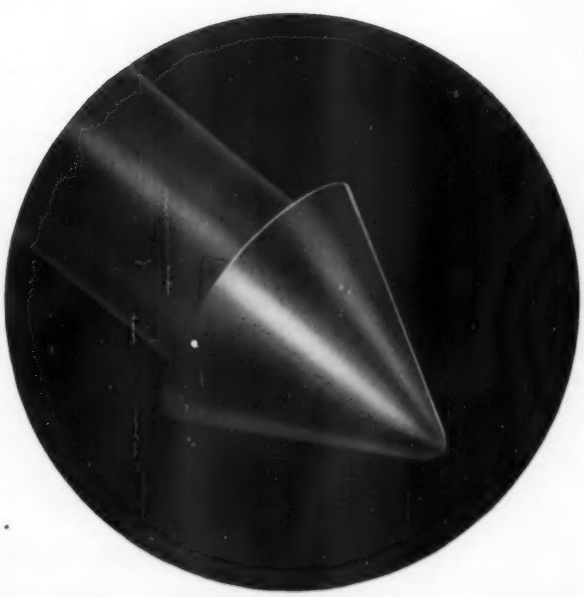
To prevent a fitting from collapsing, we always insert a piece of round steel that fits snugly into it. When pressure of a wrench is applied, the fitting will remain round, making removal quick and certain.

Harry J Miller, Sarasota, Fla



ACTUAL SIZE





American Machinist

SPECIAL REPORT NO. 438

You wanted it yesterday...
Today you have it...

ULTRASONIC DEBURRING

JOHN P. WRIGHT, associate editor

Burring need no longer be a thorn in the side of Metalworking. Here's an exclusive report on how ultrasonics will not only remove microscopic burrs from metallic parts, whether the parts have commercial or precise tolerances, but will radius edges to one ten-thousandth inch tolerance, improve surface finish to a considerable degree, and deliver the parts laboratory clean. After four years of processing thousands of parts of all descriptions and materials throughout this country, it can be stated that out of these thousands of parts none have undergone any change in physical or chemical properties. Furthermore, parts with extremely close tolerances after processing showed no dimensional change when calibrated to 0.000 005 in. Sounds too good to be true — we thought so too. But after you have looked over the case studies we have compiled here for you — form your own opinion.

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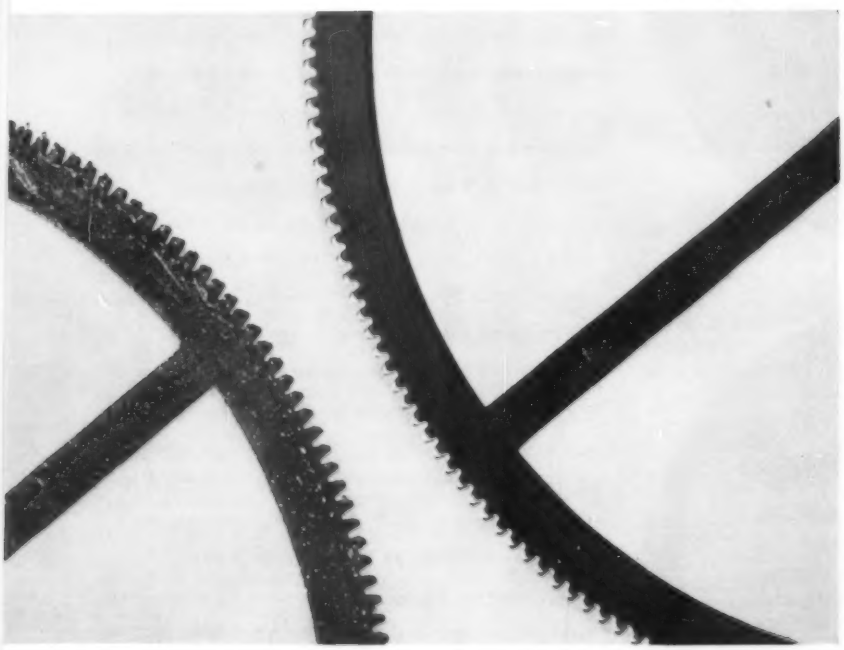
ULTRASONIC DEBURRING

X63

Craters on the moon? NO!

X63

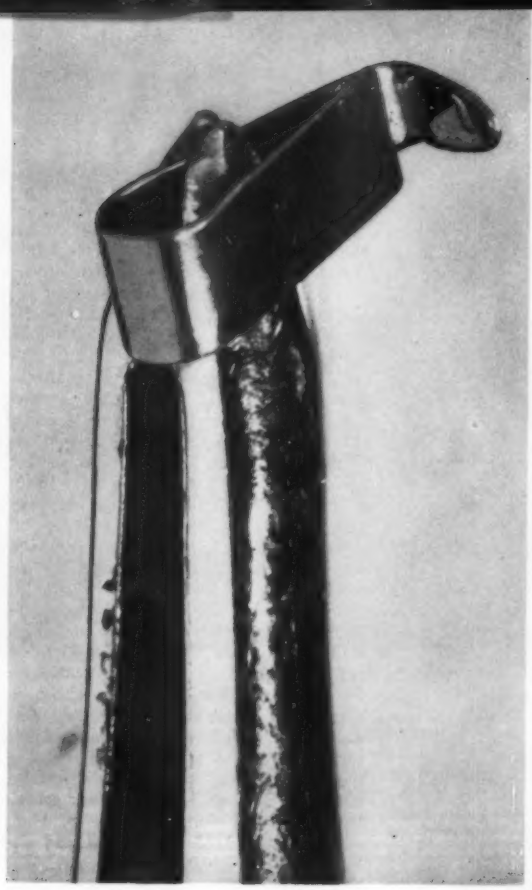
Does this give you a clue?



X6

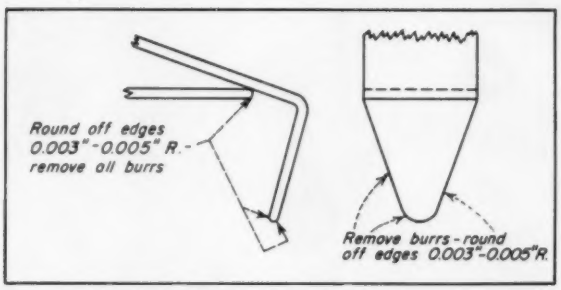
Stumped? . . .

If you are, we don't blame you, because we were just as surprised when we viewed through our microscope the burr condition of this 180 P—0.015 in. thick—1¼OD —brass precision gear. We don't wish to imply that the burr condition on this gear is a result of the manufacturer's methods, because he is highly regarded as a fabricator of the finest gears in this country. The question we are asking ourselves is, could the burr condition on gears be minimized if a little more attention were given to the cutters by tool manufacturers? Photomicrograph on the right shows a gear cut from the same lot after ultrasonic deburring. Note heavier radius at gear OD—this condition provided a tapered gear tooth (visualizing a side view) that was instrumental in obtaining a sensitive movement between meshing of fine gear train. No significant tolerance change takes place on any of the critical dimensions of these gears. At this point it is quite obvious that the saving in cost between the former method and current method of deburring is considerable. (Because of the high magnification used to take this photo, it was impossible to bring the entire burr on gear teeth into focus.)



X8

Not much larger than an eyelash... nevertheless deburring mandatory



Here's a real stickler . . .
contact trimmer stamped from 0.008 in.-thick Paliney material is 0.295 in. long by 0.095 in. wide, requiring deburring and rounded edges in specified areas as shown on sketch. Obviously, because of the size of the part, and radii called for in specific areas, it was impossible to find any conventional deburring method to successfully process this part to specifications. Comparing the conventionally accepted surface condition and sharp edges on the eyebrow tweezers with the same conditions on the ultrasonically deburred contact trimmer attests to the success of this process, particularly on parts commonly referred to as sticklers.

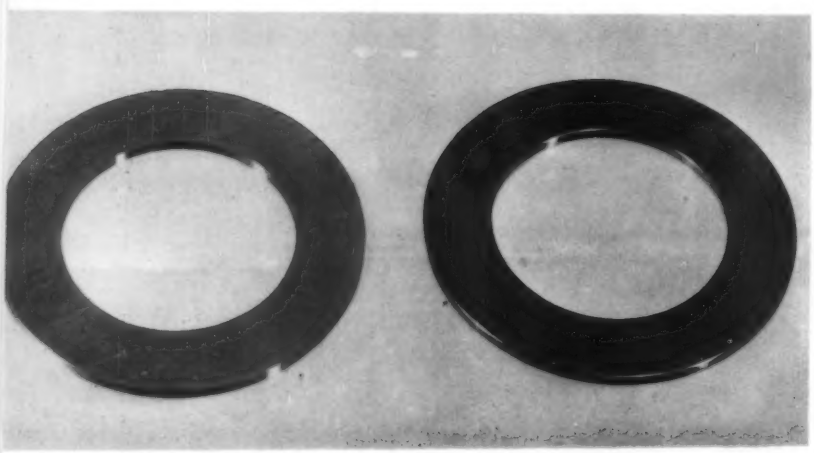
Former deburring method only 50% effective

Former method of deburring . . .
this post-brush arm and simultaneously obtaining an 8 mu in. rms finish on the 0.0856 + .0000 – .0002 shank dia, was by electropolishing. Method was only 50% effective because generally the burr was too heavy, particularly around the annular groove, for effective removal. Now the manufacturer calls out on his method sheet for the 0.0856 –in. dia to be centerless ground to 16 mu in. rms finish and then ultrasonically deburred with a minimum surface finish of 8 mu in. rms on shank dia. Before and after photos of the 0.422 in. long part graphically illustrate the success of this new method. Post arm, machined from 416 stainless steel, is deburred at rate of 63 parts per hr.

ULTRASONIC DEBURRING

BEFORE AFTER

90% saving in cost . . . was achieved when this clutch drum was ultrasonically processed to achieve the correct torque setting in the assembly of an automatic positioner. Previously, the inside diameter of the drum was processed by boring, grinding to 32 mu in. rms, hand deburring all over, then passivating. At assembly, when the spring-actuated brake band was placed inside the drum it took considerable patience during the trial-and-error selection of different spring tensions to acquire specific torque requirements. When this was achieved the clutch-drum assembly received a run-in test. During this test, more often than not, the brake drum wore down because of rough surface condition, and also from burrs breaking free and getting into the system. Naturally, the torque setting changed, requiring the assembly to be reworked. As a result of this new deburring process, the grinding operation has been eliminated, as surface finish on the drums now runs between 16 to 20 mu in. rms and drums are absolutely burr free. Assembly bottlenecks have also been eliminated because the better surface condition now permits the operator to select springs calibrated to meet specific torque requirements, and the assembly remains stable throughout the entire run-in-period. Drums are 1¼ in. OD x ½ in. high, stamped from 1/32-in. material and deburred at rate of 20.000 parts per day. X1.8

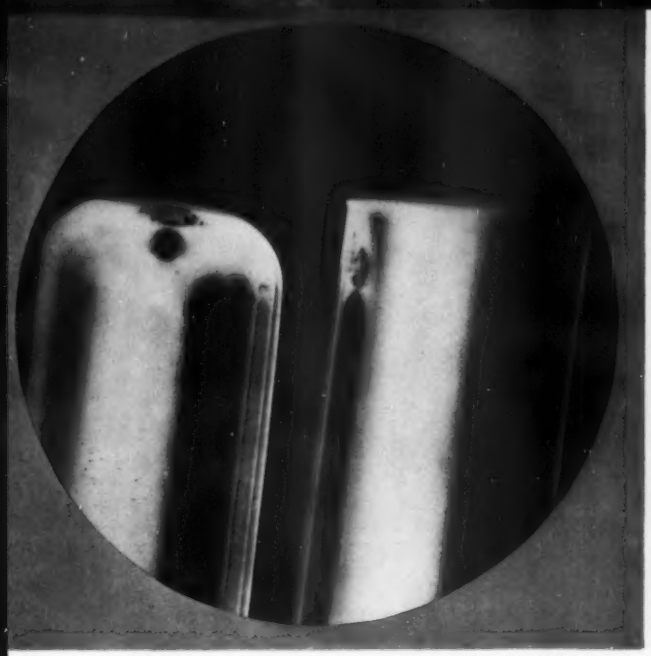


BEFORE AFTER

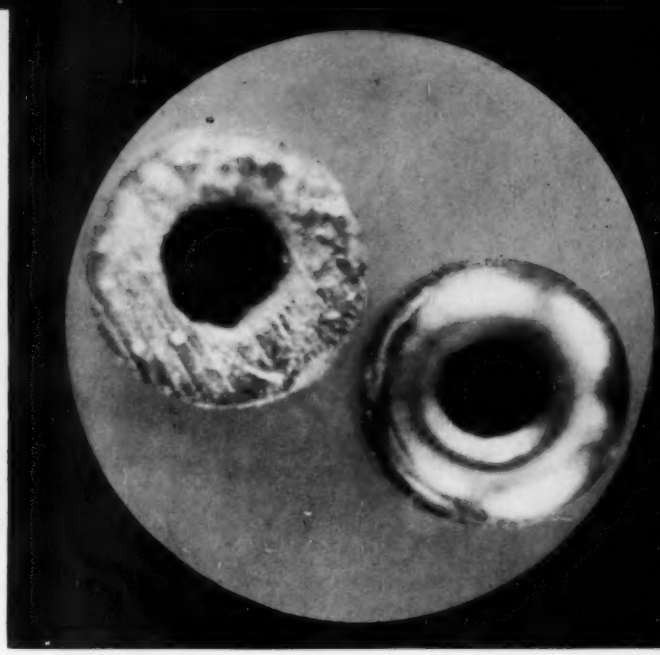
Hardened precision spacers . . . of 4130 steel are lapped flat to 1½ light bands and parallel to 0.0001 in. Specifications called for removal of all sharp edges without any change in flatness and parallelism, or any increase in surface roughness. Ultrasonic deburring produced a 0.003-in. R on all sharp edges without dimensional change significant to 0.000005 in. calibration. Note in photo that the spacer after deburring exhibits a slight improvement in surface finish, and because of the ultrasonic process is microscopically clean and free of lapping compound. Spacers, 1 in. x ⅝ in. ID, are lapped to various thicknesses for selective assembly. X2.25

BEFORE AFTER

Non-intricate brass block . . . although machined to commercial tolerances, nevertheless required a 1/16-in. R on all outside edges of profile, and sharp edge on holes removed. All known conventional deburring methods were tried and found too costly, and in many instances, deburring costs exceeded the cost of manufacturing. Now parts are deburred at the rate of 200 per hr to the required external-edge radius and a 0.005-in. R on holes. Although surface finish is not a criterion, high-frequency, time cycle, and media used in the process produced an average finish between 12 to 16 mu in. rms removing 0.001 in. of material—considerably improving appearance of part approx ⅜ x 7/16 x 1½ in. long X2

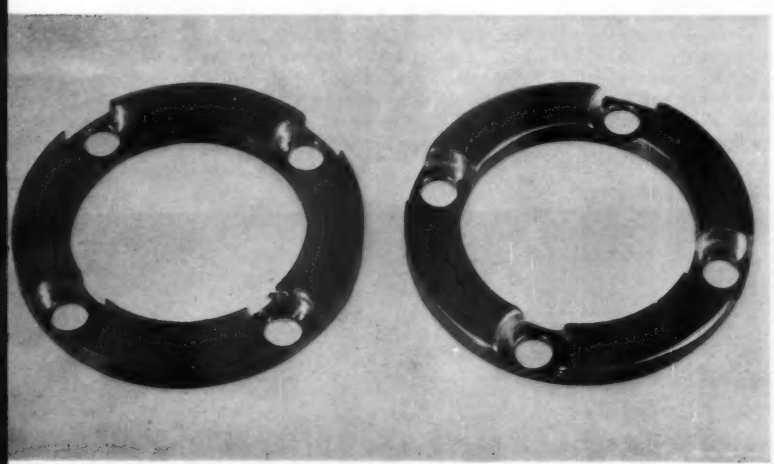


AFTER BEFORE X60



BEFORE AFTER X65

Recording needle . . .
made from 0.025-in.-dia stainless-steel hypodermic tubing, required a 0.016 ± .001-in. radius on end of needle, and a 0.002-in. R on edge of hole. Photomicrograph shows the part, before and after. Ends of needles are now processed 95% faster and cheaper than former method and produces a higher-quality part with a 4 mu in. rms finish, and consistent tolerances on the radii. Critical radii and good surface finish are essential because the rate of recording is adjustable and at some speeds there would be no visible ink line unless these specifications were held. Formerly, needles were form turned and hand polished on a jeweler's lathe



BEFORE AFTER X2.125

Brass retainer ring . . .
requires a 0.005-in. radius on all sharp corners. Parts are processed at the rate of 50,000 per day at very little cost. Former method of tumbling and hand burring proved costly and almost impossible because of inaccessible areas around counterbore. Rings are 1 x 11/16 in. x 0.083 in. thick

Here's what we can tell you about the ultrasonic deburring process . . .

1. The process is a secret one. It requires high-cost equipment and intensive training of technicians to operate it.
2. In broad terms, the process parallels ultrasonic cleaning (AM—Jan 2 '56, p 97) with but two exceptions: greater power is utilized, and denser media are used.
3. Burrs and sharp edges are predominantly attacked first—smooth flat surfaces are imperceptibly affected. The latter statement is a variable depending upon the length of time parts are subject to the process.
4. When burrs on a part are excessive—in order to maintain close tolerances required on the finished part, and in order to regulate time cycle part is in media, some hand deburring is necessary. However, if the radii tolerances and part tolerances are liberal, no previous hand deburring is necessary.
5. Generally, to process parts, no fixturing is necessary. However, if the nature of the parts warrants fixturing, no difficulty is encountered.
6. Parts as received are first degreased, lowered into the sound field, processed, inspected, dried in an infra-red oven, treated for rust prevention, and packaged according to specifications.
7. Parts of an average nature can be processed at the rate of 100 per hour.

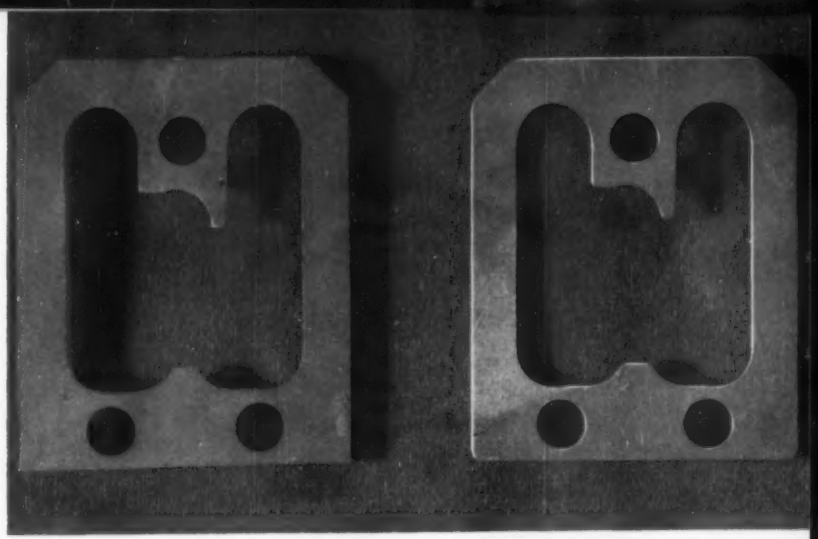
ULTRASONIC DEBURRING

Besides deburring, what else can this process do for you?

1. Hold any tolerance on a radius, providing the tolerance can be measured.
2. Improve surface finish—the degree of improvement is a factor of how long the parts remain in the media. In any case, because of the nature of this process, parts are of a higher quality both functionally and from an appearance standpoint.
3. Produce finished parts laboratory clean—if necessary microscopically clean—remove corrosion marks.
4. Process anodized or plated parts—however, the finish will be removed from radiused edge.
5. Masking permits more than one size radius on a given part.
6. Because parts are laboratory clean, subsequent soldering, plating, impregnating, etc., operations are of higher quality.
7. Deburr internally—providing the inside diameter is ¾ in. or larger and not too deep.

Ultrasonic deburring will not . . .

1. Change critical tolerances beyond 0.000005 in. measurement.
2. Produce surface hardness nor bring about any change in the surface hardness of a part.
3. Change the physical or chemical properties existing in a given part.

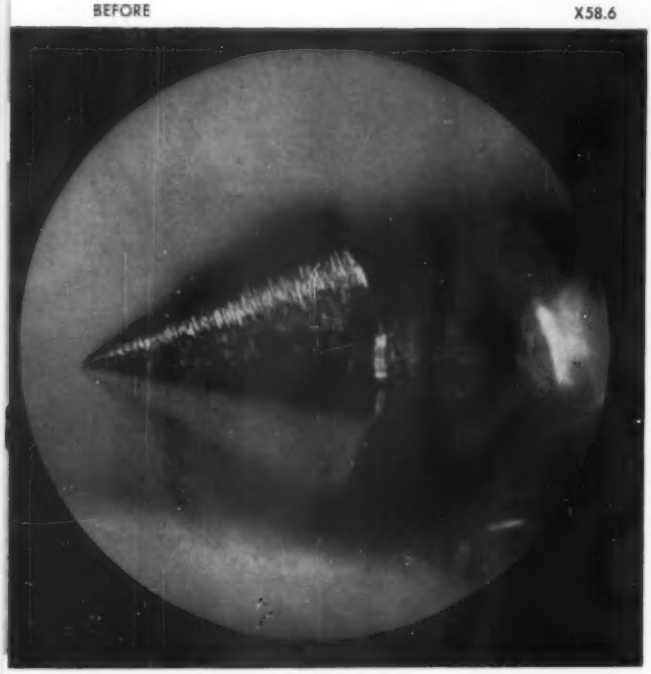


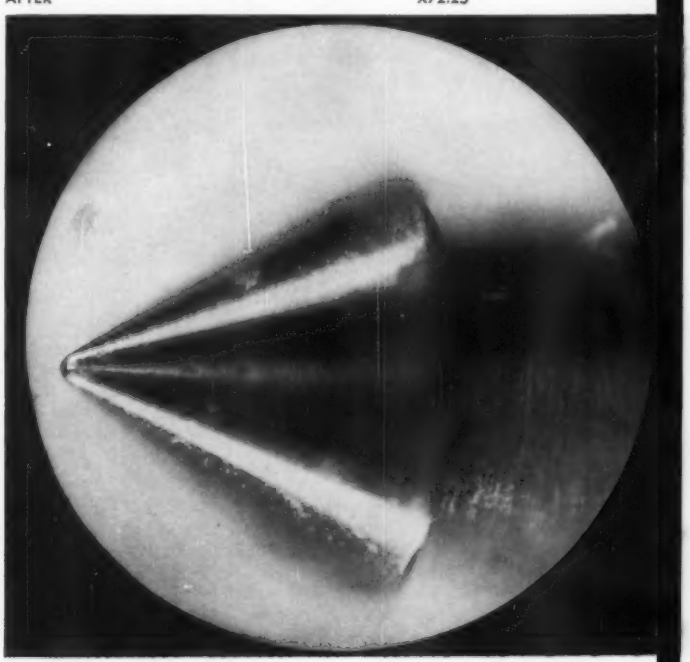
BEFORE AFTER

Stamped spring . . .
is a highly critical part used in the assembly of a seismograph-galvanometer and must be microscopically burr free because it functions within an extremely close gap. A burr of any size will cause a reading error or render the spring inoperative. Originally sharp edges on the spring were hand scraped under a microscope, and the feather edge from scraping removed by hand buffing. Burring operation took 30 min. per spring. Now 600 springs per hr are processed ultrasonically with a 0.003-in. R on all edges, and because of the improved surface finish (laboratory clean) subsequent soldering and functional operations are vastly improved. Burring cost of these springs (0.008 in. x 1⅛ in. x 1⅜ in.) has been reduced 98% X1.8

Jewel-bearing pivot . . .
major dia 0.045 in., taper length 1/32 in., shank length 1/32 in., hardened R_c 65, was formerly ground, polished, and buffed at final finishing operations. Because of its microscopic size and surface hardness it was impossible to achieve any amount of success at the finishing operations. Any amount of success that was achieved was offset by a short pivot life because the buffed surface simply flaked off when the pivot was in use, and it was also impossible to maintain a consistent radius at the point. Ultrasonically, the pivot point is held between 0.0023 and 0.0025 in. R, surface finish between 2 to 4 mu in. rms, and pivot life to date has been incalculable because none of the pivots so far has worn out

BEFORE X58.6 AFTER X72.25





BEFORE

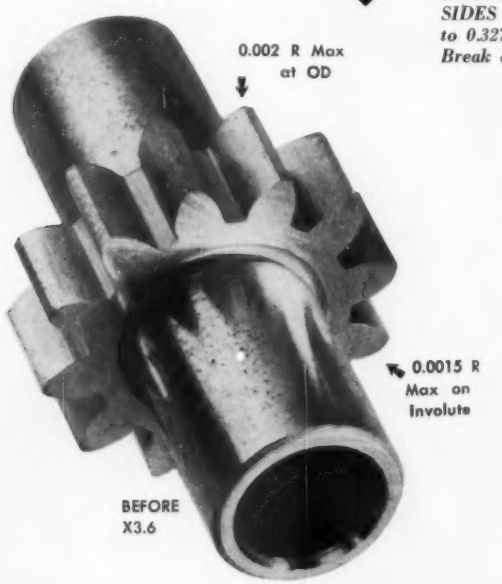
AFTER

Turbine rotor . . .
machined from a C1137 steel billet presented a very difficult and costly deburring problem, particularly on the trailing edge of blade where it was impossible to machine a 0.007 ± .002-in. R. Photo of rotor before deburring shows heavy burr on trailing edge and larger radius machine on leading edge of blade. Hand deburring was tried and given up as futile. Photo, after deburring, shows slight radius on all sharp edges and comparator inspection consistently showed radius on trailing edge within tolerance as well as the 0.018 ± .002-in. R on leading edge. Rotor 5½ in. in dia cost approx $500 and turns at 68,000 rpm X1.3

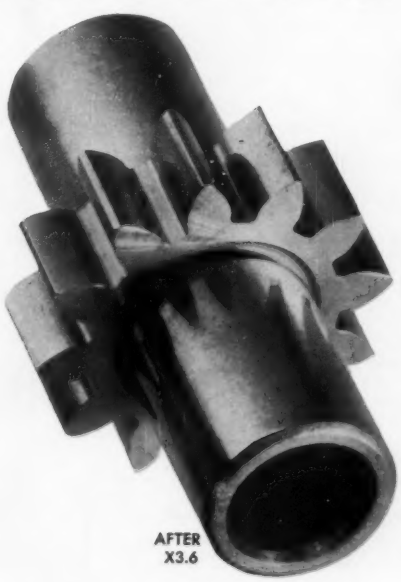
Rejects amounted to 35% . . .
when this highly accurate pump gear was deburred to specifications by hand stoning under a microscope. Each gear required 30 min of hand stoning. Because the hardened gears turned over at 12,000 rpm to deliver a flow of 3000 psi, any irregularities in the specified radii cut seriously into the efficient operation of the pump. To protect sharp edge on gear teeth, gears were mounted on a peg board during ultrasonic deburring, then coated with an anti-corrosive solution, and packaged in individual vials. Production amounted to 400 gears per day for an over-all saving in manufacturing cost of 85%. Final inspection showed a surface improvement to 6 mu in. rms on bearing diameters and faces of gear, no dimensional change when calibrated to 0.000005 in., and rejects to date after deburring are zero

PUMP-GEAR

GEAR DATA—0.010" case harden R-15N (90-91½)
OVER-ALL LENGTH—1"
GEAR OD—0.6249 $^{+\ .0003}_{-\ .0000}$ *—16 mu in. rms*
WIDTH OF GEAR—0.194 $^{+\ .0003}_{-\ .0000}$ *—8 mu in. rms*
GEAR PD—0.5415—32 mu in. rms
SHANK DIA—0.3275 $^{+\ .0000}_{-\ .0001}$ *—8 mu in. rms*
INTERNAL SPLINE—(not shown)
PD—0.2083
MD—0.2302 ± .001
INVOLUTE PROFILE ERROR MAX—0.0005
Break all sharp corners on internal spline 0.0015" R max
SIDES OF GEAR—flat and parallel within 0.0002" per in. – square to 0.3275 dia within 0.0002" per in.
Break all sharp corners 0.0015-in. R max unless noted

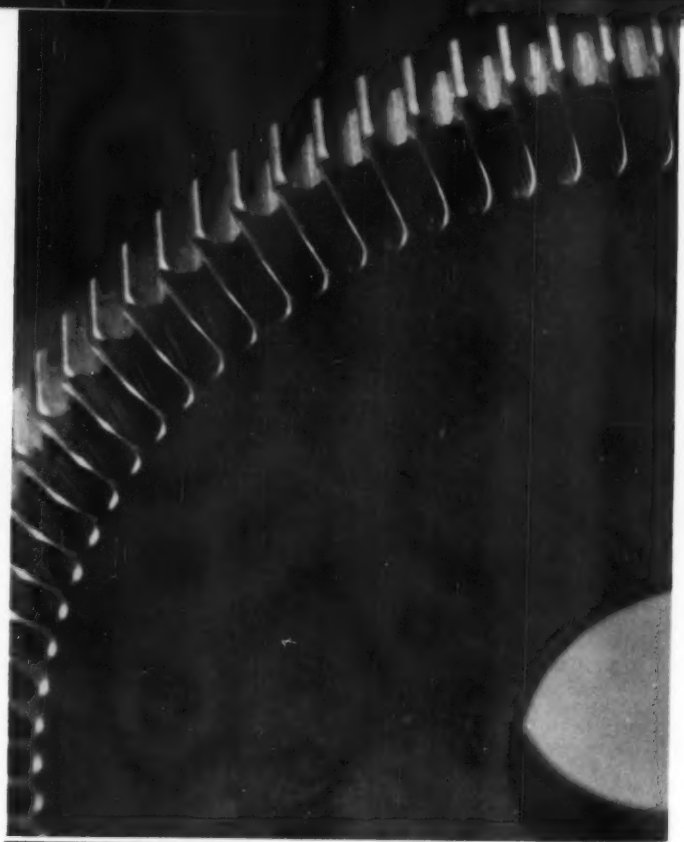


BEFORE X3.6



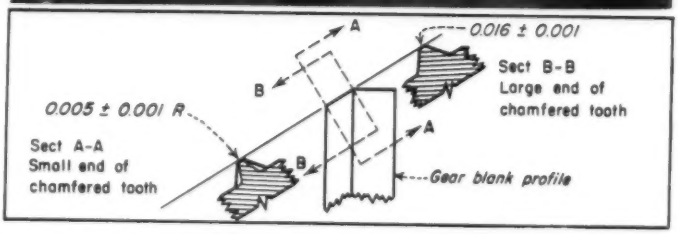
AFTER X3.6

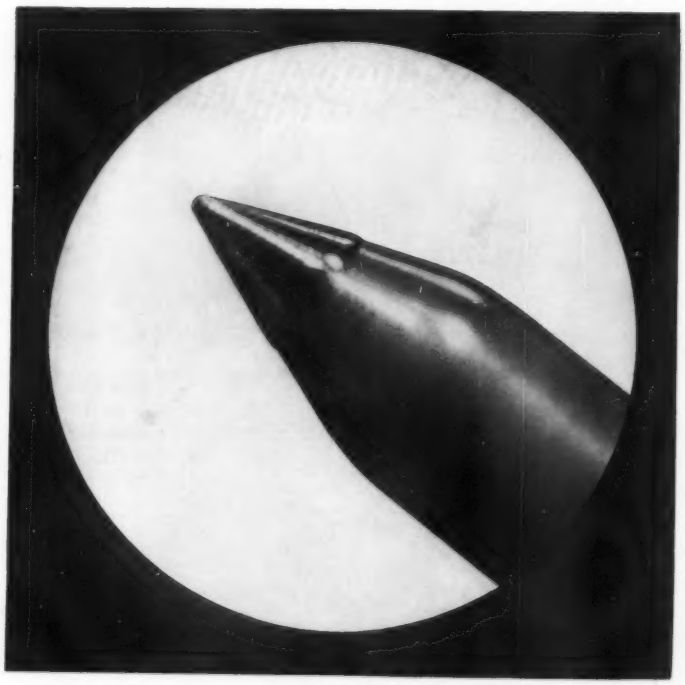
ULTRASONIC DEBURRING



Graduated radius . . .
required on chamfered portion of gear tooth (see sketch) is required to permit ease of engagement on a three-gear clutch drive (center gear is chamfered on both edges). Bids had already been released for a special $30,000 machine that would radii the chamfered tooth form as shown in sketch. In the interim, ultrasonic deburring was tried, and the success of this experiment is evident in the photo. Here's how it was done: after deburring the gear all over, the major diameter was masked and the gear then subjected to further deburring. Because the cross-section of the chamfered tooth form is wedge-shaped (offering a difference in material mass), and because this process predominately attacks sharp corners with uniformity, this portion of the gear tooth has radii within specified tolerances X4.5

GEAR DATA:
GEAR TOOTH PROFILE—32 mu in. rms max.
DP—64
PD—0.750
MD—0.778 $^{+\ .000}_{-\ .002}$
GEAR BLANK THICK.—0.125—8 mu in. rms max.
Total composite error – 0.001
Break all sharp edges 0.010" unless noted





Osmium-tipped needle . . .
for long playing records and juke boxes is 0.016-in. dia and required a radius ranging from 0.0007 to 0.0009 in. on the tip. After grinding the osmium tip to a sharp point and a 32 mu in. rms, it was formerly finished by hand polishing and lapping. Ultrasonically the tip is processed to specified tolerances and a surface finish ranging between 4 to 6 mu in. rms X86

Further information on ultrasonic deburring can be obtained from any of these three plants:

Precision De-Burring Co—Dallas, Texas (Home Office)

Ultra-Sonic De-Burring Co of Los Angeles

Ultra-Sonic De-Burring Co—New Hyde Park, LI, NY

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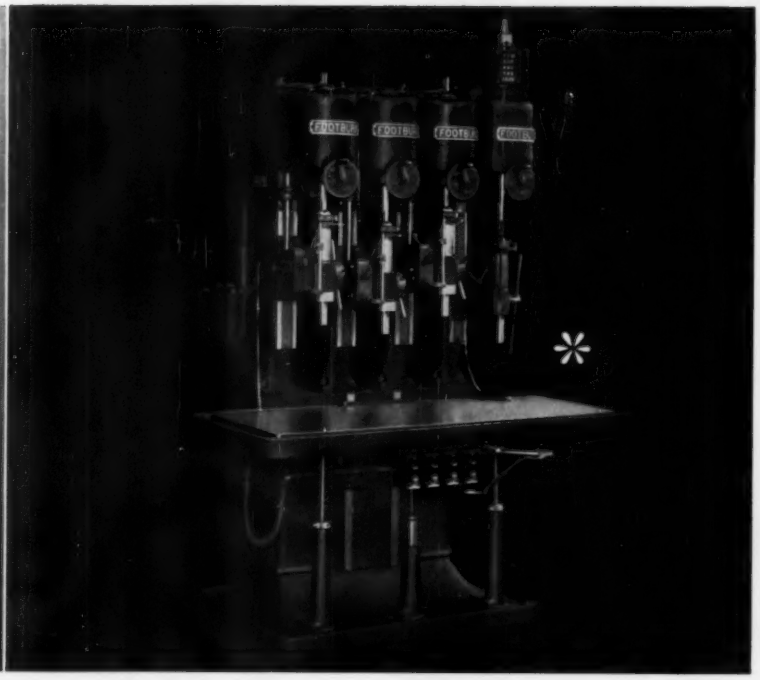

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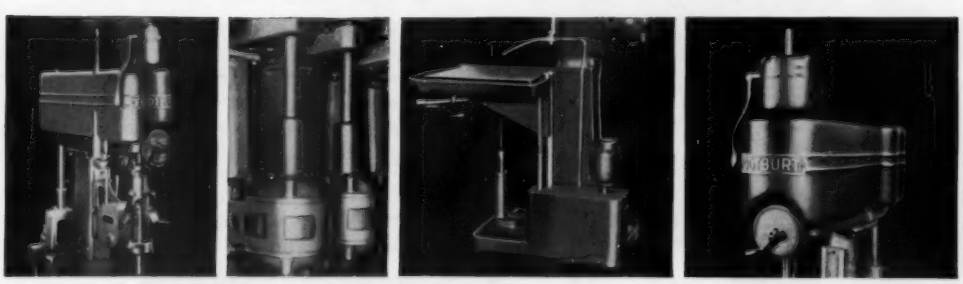

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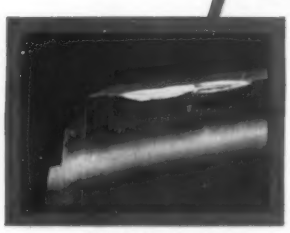
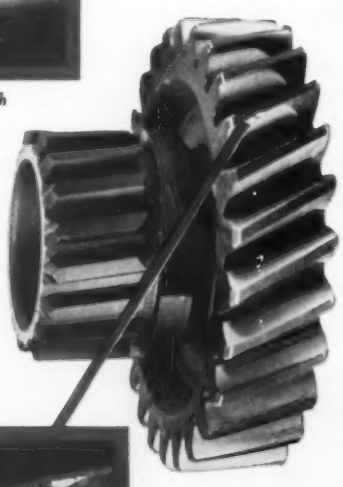
MACHINE TOOLS

RED RING
HARD GEAR HONING
PRODUCES QUIET GEARS



Nicked Gear Tooth



Same Gear Tooth After Honing

Hard gear tooth honing is an entirely new approach to the vexing problem of intolerable gear noise arising from nicks, burrs, tooth roughness and minor heat-treat distortions.

Honing is not only far more effective than other processes used to combat gear noise but it is also much more economical. And it produces none of the undesirable after effects inherent in other processes such as heat checks, soft skin or residual stresses in the tooth metal.

Gear honing does four important things:

- Smooths off the swaged or raised metal surrounding tooth nicks.
- Eliminates burrs.
- Materially improves surface finish.
- Corrects minor heat-treat distortions in profile, index and lead.

When used as a final routine finishing operation following heat-treat, it eliminates the tedious and costly operation of searching for nicks and then correcting them. It improves the quality, uniformity and performance of all gears produced.

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5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Patents pending

7631

Tolerances and Limits . . IV

Source: Tentative American Standard "ASA Y14.5—American Drafting Standards Manual—Sect 5: Dimensioning and Notes" to be published, upon acceptance as a standard, by the American Society of Mechanical Engineers, 29 W 39th St, New York 18, N Y

Dimensioning for Fits. For interchangeable manufacture, the tolerances on dimensions must be such that an acceptable fit will result from assembly of parts having any combination of actual sizes that are within the tolerances. See Fig 13.

Fig 14 shows a method of dimensioning mating parts that must fit one another, when they do not need to be interchangeable. The size of one part need not be held to a close tolerance, because it is to be modified at assembly to the size that is necessary for the desired fit.

"Hole Basis" and "Shaft Basis". To specify the dimensions and tolerances of an internal and an external cylindrical surface so that they will fit together as desired, it is necessary to begin calculations by assuming either the minimum hole size or the maximum shaft size.

A basic hole system is a system of fits in which the design size of the hole is the basic size and the allowance is applied to the shaft.

A basic shaft system is a system of fits in which the design size of the shaft is the basic size and the allowance is applied to the hole.

Note: For further information on limits and fits, see ASA B4. 1-1955 or subsequent revision thereof.

"Basic Hole" System. Limits for a fit in the basic hole system are determined by (1) specifying the minimum hole size, (2) determining the maximum shaft size by subtracting the desired allowance (minimum clearance) from the minimum hole size for a clearance fit, or adding the desired allowance (maximum interference) for an interference fit, and (3) adjusting the hole and shaft tolerances to obtain the desired maximum clearance or minimum interference. See Fig 15. Tooling economies can often be realized by calculating from the basic-hole size, providing the size selected can be produced by a standard tool (reamer, broach, etc.) or gaged with a standard plug gage.

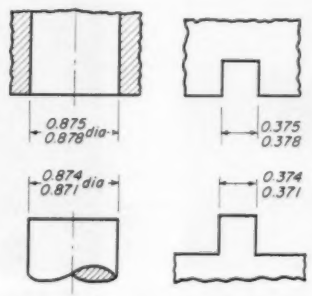


Fig. 13—How to indicate dimensions of surfaces that are to fit closely

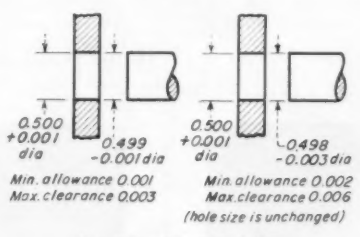


Fig. 15—"Basic hole" fit

"Basic Shaft" System. Limits for a fit in the basic-shaft system are determined by (1) specifying the maximum shaft size, (2) determining the minimum hole size by adding the desired allowance (minimum clearance) to the maximum shaft size for a clearance fit, or subtracting for an interference fit, and (3) adjusting hole and shaft tolerances to obtain the desired maximum clearance or minimum interference. See Fig 16. The "basic shaft" method is recommended only if there is a particular reason for it; for example, where a standard size of shafting can be used.

Positional Tolerances. Figs. 1 through 5 illustrate the locating of holes or other features by means of rectangular or polar coordinates. In the past, these coordinates have been shown with individual tolerances predominantly. The engineering intent can often be expressed more precisely if locations are given as

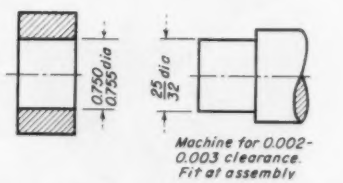


Fig. 14—How to dimension non-interchangeable parts for a close fit.

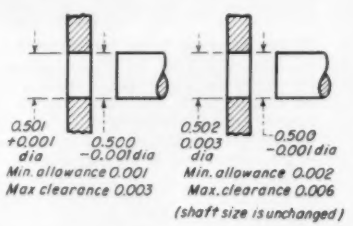


Fig. 16—"Basic Shaft" fit

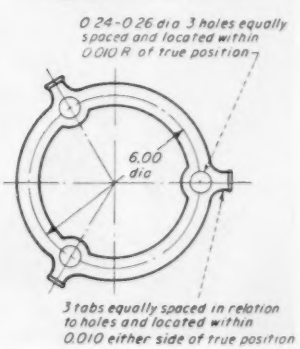

0.24-0.26 dia 3 holes equally spaced and located within 0.010 R of true position
6.00
dia
3 tabs equally spaced in relation to holes and located within 0.010 either side of true position

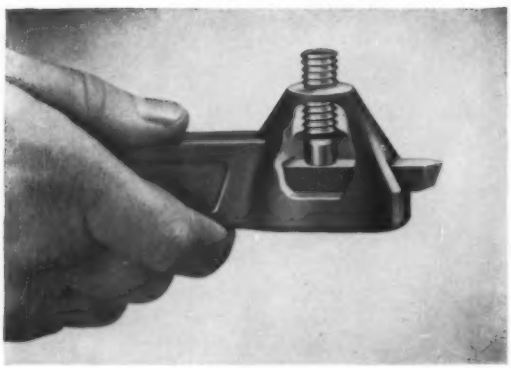
Fig. 17—True-position dimensioning

True Positions, with tolerances to state how far actual positions can be displaced from True Positions. Positional tolerancing may be applied for the location of features by stating in the note the allowable tolerance.

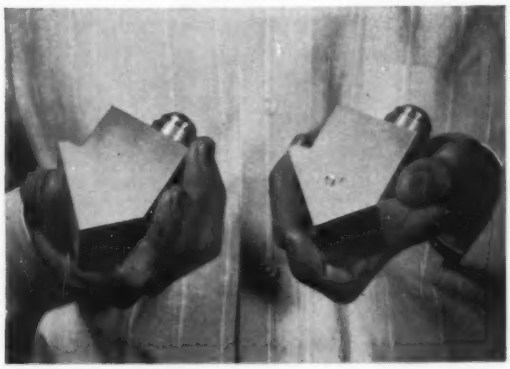
Features such as holes and bosses may be allowed to vary from the specified position in any direction from the true-position axis, while other features such as slots may be allowed to vary from the specified position on either side of the true position plane. Therefore, there are

Practical Tooling Tips

Everyday more and more shops are using standard Vlier Tooling Accessories in place of custom-made devices for both tooling and original equipment applications. The precision construction, product uniformity and quick availability of these simple time-savers have made them tool room favorites. Why don't you start saving from their use?

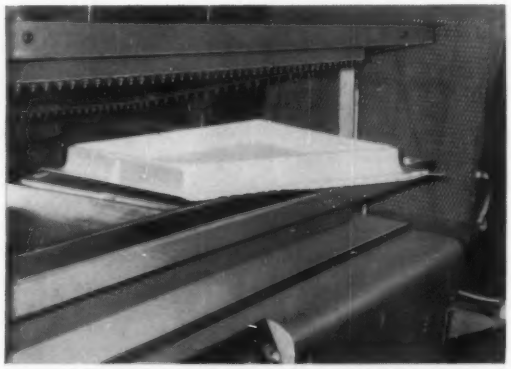


TO GET GREATER TOOL BIT RIGIDITY replace the tool holder screw with a Vlier Swivel-Pad® Clamp. The large, flat pad face provides many times more clamping area. Bits can be held tighter, reducing chatter and vibration. Small, narrow cut-off blades, multipoint tools, even stub ends can be rigidly held. Unique ball joint construction gives smooth angle adjustment in all directions.



EASY WAY TO STOP MARRING surface of part held in fixture. The part on the left was securely held in the fixture with a Vlier Swivel-Pad® Clamp. The scrapped part on the right was held with an ordinary set screw. With the Vlier Swivel-Pad® Clamp the pad stops at first contact with the part; screw torque is absorbed by a ball, preventing damage to the part. This exclusive ball joint construction also provides adjustment to off-angle surfaces.

SPRING PLUNGERS LET WRENCH DO MULTIPLE DUTY—The compression tool shown above is used to attach connectors to electrical wires. Formerly, each size wire connector required a different size tool. But now, through the use of Vlier Spring Plungers, one tool attaches all sizes of connectors—through the use of changeable jaws. The appropriate jaw for any size connector is easily inserted, accurately positioned, and held in place with a Vlier Spring Plunger.



THE RIGHT AMOUNT OF END PRESSURE AND NO MORE is what this spring plunger application calls for. More than 150 Vlier Spring Plungers are used to hold a plastic sheet in position during the forming operation of a plastic refrigerator door liner. Spring Plungers provide just the right amount of pressure to produce a perfect liner.

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Tolerances and Limits . . V

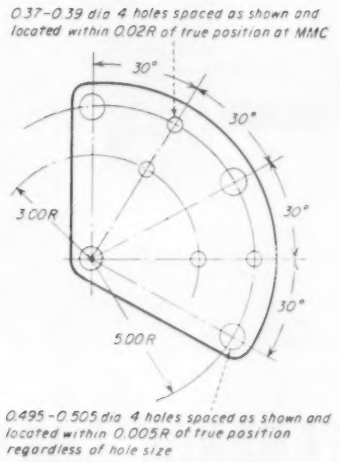

0.37–0.39 dia 4 holes spaced as shown and located within 0.02R of true position at MMC
30°
30°
30°
30°
3.00R
5.00R
0.495–0.505 dia 4 holes spaced as shown and located within 0.005R of true position regardless of hole size

Fig. 18—True-position dimensioning

two methods for applying positional tolerancing. See Figs 17 and 18.

(a) Where features are located by dimensions to their axes and where the location may be allowed to vary in any direction, the zone of tolerance, which in this case is a cylinder, shall be specified by giving either the diameter of the circle or its radius, with either of the following typical forms:

1. 6 HOLES LOCATED AT TRUE POSITION WITHIN 0.010 DIA.

2. 6 HOLES LOCATED WITHIN 0.005 R OF TRUE POSITION.

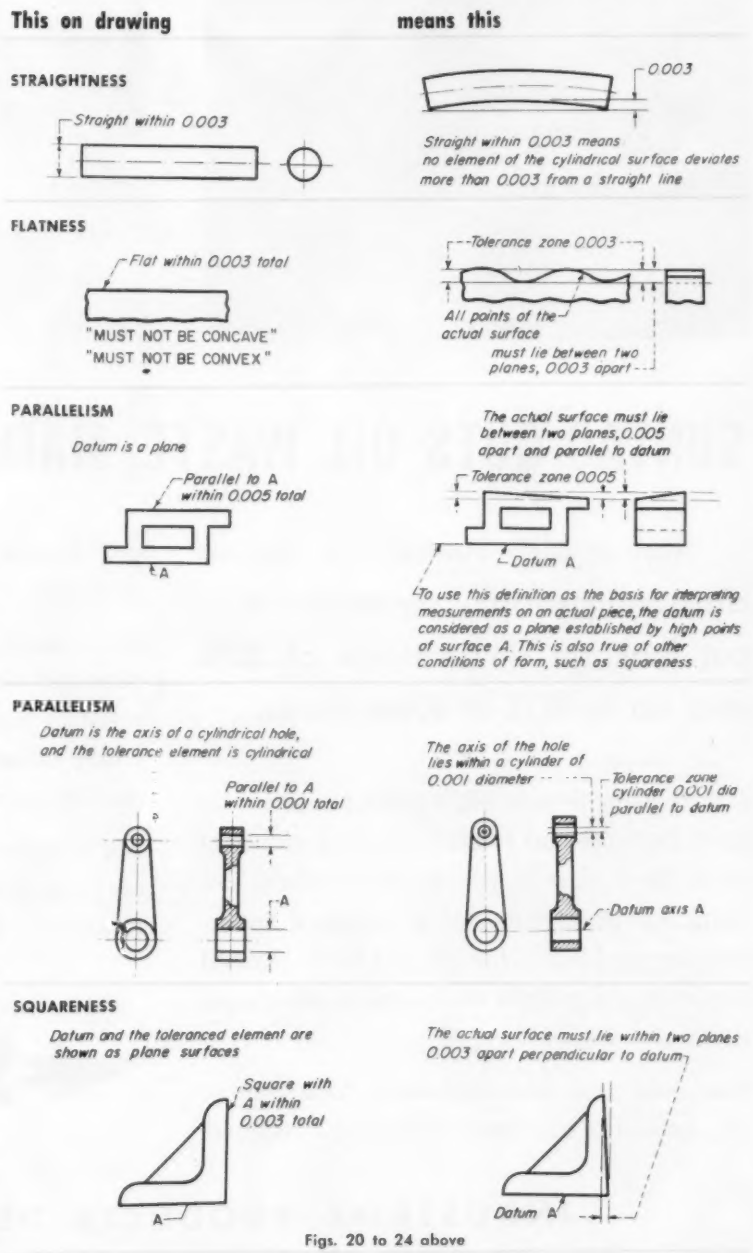
Note: Where the note "LOCATED WITHIN 0.005 OF TRUE POSITION" has been in use on existing drawings, it is to be interpreted as meaning the same as number 2 above.

(b) Where features are located by dimensions to a center plane or to one surface of the feature, positional tolerancing shall be applied by the use of either of the following two typical forms:

1. 6 SLOTS LOCATED AT TRUE POSITION WITHIN 0.010 WIDE ZONE.

2. 6 SLOTS LOCATED WITHIN 0.005 EITHER SIDE OF TRUE POSITION.

Note: Where the note "LOCATED WITHIN 0.005 OF THE TRUE POSITION" has been in use on existing drawings, it is to be interpreted as meaning the same as number 2 above.


This on drawing
means this
STRAIGHTNESS
Straight within 0.003
0.003
Straight within 0.003 means no element of the cylindrical surface deviates more than 0.003 from a straight line
FLATNESS
Flat within 0.003 total
"MUST NOT BE CONCAVE."
"MUST NOT BE CONVEX"
Tolerance zone 0.003
All points of the actual surface must lie between two planes, 0.003 apart
PARALLELISM
Datum is a plane
Parallel to A within 0.005 total
A
The actual surface must lie between two planes, 0.005 apart and parallel to datum
Tolerance zone 0.005
Datum A
To use this definition as the basis for interpreting measurements on an actual piece, the datum is considered as a plane established by high points of surface A. This is also true of other conditions of form, such as squareness
PARALLELISM
Datum is the axis of a cylindrical hole, and the tolerance element is cylindrical
Parallel to A within 0.001 total
A
The axis of the hole lies within a cylinder of 0.001 diameter
Tolerance zone cylinder 0.001 dia parallel to datum
Datum axis A
SQUARENESS
Datum and the toleranced element are shown as plane surfaces
Square with A within 0.003 total
A
The actual surface must lie within two planes 0.003 apart perpendicular to datum
Datum A

Figs. 20 to 24 above

The true position of the feature is established by untoleranced dimensions. *Information must be included specifying that the general toler-*

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Tolerances and Limits . . VI

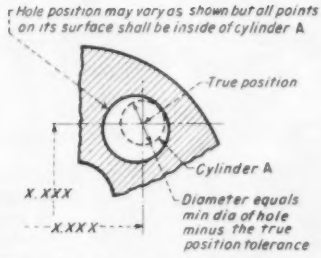

Hole position may vary as shown but all points on its surface shall be inside of cylinder A
True position
Cylinder A
X.XXX
X.XXX
Diameter equals min dia of hole minus the true position tolerance

Fig. 19—True-position interpretation

ances do not apply to the dimensions establishing the true position.

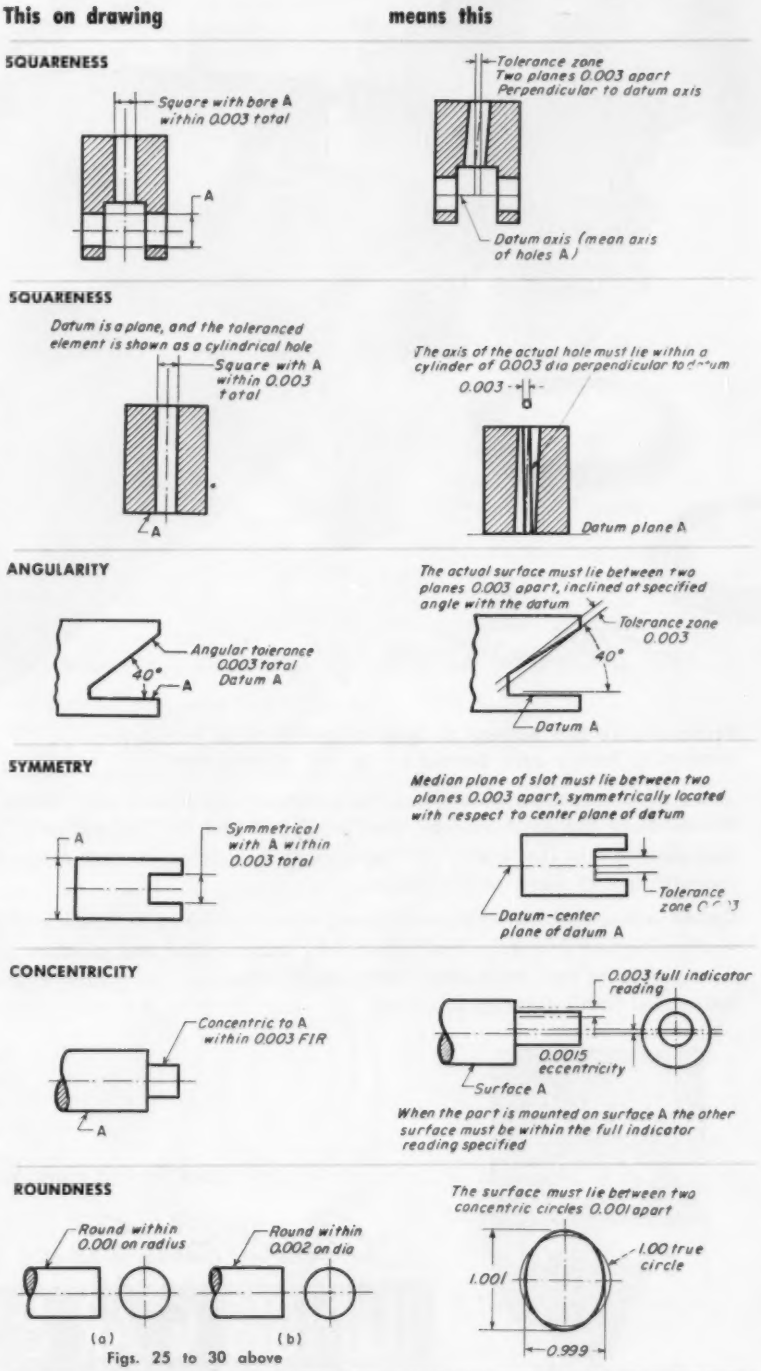
True Position Interpretation. When applied to a cylindrical feature such as a hole, the note "LOCATED AT TRUE POSITION WITHIN .XXX DIA" OR "LOCATED WITHIN .XXX R OF TRUE POSITION" is interpreted as follows:

In terms of the cylindrical surface of the hole, as in Fig 19, it means that all elements on this surface shall be inside a cylinder having a diameter equal to the minimum diameter of the hole minus the true position tolerance (diameter or twice the radius of the tolerance circle), the axis of the cylinder being located at true position.

In terms of the axis of the hole, it means that the axis must fall within a cylindrical-tolerance zone having a diameter equal to the true-position tolerance and having its axis located at the true position.

Tolerances of Form. Tolerances of form state how far actual surfaces are permitted to vary from the perfect geometry implied by drawings. Expressions of these tolerances refer to straightness, flatness, parallelism, squareness, angular displacement, symmetry, concentricity, roundness, etc. Figs 20 through 30 illustrate recommended expressions for specifying tolerances of form on drawings.

Tolerances of form often affect one another; parallelism includes flatness or straightness, etc. Tolerances of form are also interrelated with tolerances that limit size of position. Figs 20 to 30 consider tolerances of form individually, ignoring the effects of combination with other tolerances of form, size or position.


This on drawing
means this
SQUARENESS
Square with bore A within 0.003 total
A
Tolerance zone Two planes 0.003 apart Perpendicular to datum axis
Datum axis (mean axis of holes A)
SQUARENESS
Datum is a plane, and the toleranced element is shown as a cylindrical hole
Square with A within 0.003 total
A
The axis of the actual hole must lie within a cylinder of 0.003 dia perpendicular to datum
0.003
Datum plane A
ANGULARITY
Angular tolerance 0.003 total Datum A
40°
A
The actual surface must lie between two planes 0.003 apart, inclined at specified angle with the datum
Tolerance zone 0.003
40°
Datum A
SYMMETRY
A
Symmetrical with A within 0.003 total
Median plane of slot must lie between two planes 0.003 apart, symmetrically located with respect to center plane of datum
Tolerance zone
Datum-center plane of datum A
CONCENTRICITY
Concentric to A within 0.003 FIR
A
0.003 full indicator reading
0.0015 eccentricity
Surface A
When the part is mounted on surface A the other surface must be within the full indicator reading specified
ROUNDNESS
Round within 0.001 on radius
Round within 0.002 on dia
(a)
(b)
The surface must lie between two concentric circles 0.001 apart
1.001
1.00 true circle
0.999

Figs. 25 to 30 above

Where on earth will you find such machinery...

Battery of four No. 4A Warner & Swasey turret lathes for accurate machining of heavy gear blanks to 28" diameter.

...at Illinois Gear, of course.

Pictured here is a battery of large precision turret lathes for machining heavy gear blanks *up to 28" in diameter!*

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Talking Shop . . .

Scrapped Paper

A DRIVE against paperwork has been started at Cooper-Bessemer. Most such drives start by adding to the load of paperwork and this one began with a 5-man committee headed by the controller. This committee, however, has eliminated 855,075 individual records from the shop, 277,274 from sales and order handling, 18,924 from engineering, and 19,821 from accounting. Another benefit has been the speeding up of operations. For example, the time to handle shipments of repair parts has been reduced from days to hours.

Cutting Shortcut

YOU CAN FLAME cut most non-ferrous metals with standard shielded-arc, consumable-wire welding equipment. According to Air Reduction, either manual or automatic Aircomatic equipment can be adapted by adjusting gas flow and steel wire speed. The arc is maintained between the leading edge of the wire and the leading edge of the cut. On ¼-in. plate, speeds are up to 132 ipm on aluminum and 85 ipm on stainless. Other metals that have been cut include chrome steel, nickel, Monel, copper, brass, aluminum bronze, magnesium, and titanium.

Why Age Castings?

THE IDEA that all iron castings should be "cured" by leaving them outdoors for a number of months was written off when the Gray Iron Founders' Society released their "Survey Report To Product Engineers." This is a report to design engineers in metalworking industries who answered a recent questionnaire designed to quiz engineers' knowledge of gray iron castings.

The question on aging was as follows: "Given a properly cleaned gray iron casting, would you say that aging it outdoors several months improves machinability or not?" Here's how engineers voted: 22% checked 'Quite a bit'; 30% checked 'A little'; and 48% 'Makes no difference.' According to Charles F Walton, technical director of the Society, 'Makes no difference' is correct. If a casting is *not* well cleaned, leaving it outdoors will help machinability, because some of the hard, black oxide and adhering sand, if any, would be loosened by rusting. Thus the idea did have merit at one time—years ago before modern cleaning equipment was introduced to foundries.

Today, however, with many types of efficient cleaning methods and closer metallurgical control, progressive foundries produce castings which are well cleaned and don't need aging to make them machinable.

Mr Walton also pointed out that there may be a slight stress-relieving effect in leaving castings outdoors if there were extreme variations in temperature, but this would be so slight it would not change the casting's machinability.

Why Were They Fired?

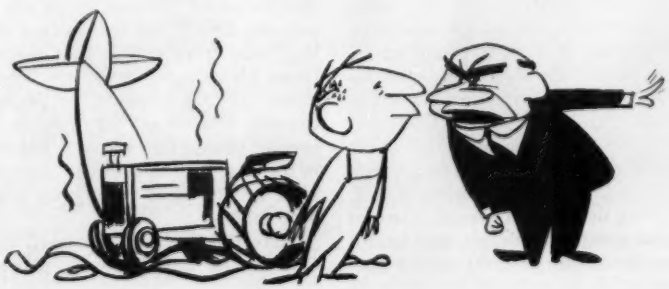
ABSENTEEISM and poor performance were the principal reasons given in a series of firings reported by 129 personnel officers to the American Management Association. Absenteeism was the most common reason and, oddly enough, more men were fired for this reason than women. Most previous surveys have shown that absenteeism is more prevalent among women. The answer may be that the boss is more tolerant of their absences. The survey indicates that women are fired for poor performance (low output or poor quality) about twice as often as men. No other reason approached these two in frequency. "Poor attitude" or failure to get along with fellow workers (they sound like much the same thing) were mentioned in about 12% of the cases. There were a few cases of false applications, of theft, and of reporting for work drunk. There was one case of "damaging an airplane with a tractor"—presumably a reason that would be peculiar to an aircraft plant.

Carbide Brazing

WHEN YOU braze the carbides containing titanium, tantalum, and tungsten combinations, no special materials or techniques are required under normal conditions. However, if there is a long heating period, high temperatures, or if you are rebrazing, you will have to use a special flux, according to Fred Kelly of GE's Metallurgical Products Department. This flux must dissolve the oxides of titanium and tantalum encountered. Two special fluxes, which contain silicon or boron additives, have been found satisfactory. If you have trouble locating such a flux, write us for details.

Horsepower Rank

FARMERS ARE NOT just catching up with industry in their mechanization, they are leaving it far behind. A study made by Thor Power Tool Co shows the average farmer has 36 hp in his tractors, workshop tools, and other machines, while the average industrial worker has only 7 hp. In 1939 the farmer had 10.5 hp, the average factory worker had 4.7 hp at his dosposal.



FOREIGN REPORT . . . No. 5 on Russia

Russia's Conveyorized Machine-Tool Production

An eyewitness report by
Peter Trippe
London Staff Editor

MOSCOW—The Russians are building high-speed, universal lathes on a production line in Moscow at a rate of one every 15 minutes. Twelve thousand of these machines come off the assembly line in a year's time. They are built in much the same way that an automobile is made, only to closer tolerances. Remember that the 12,000 units represent the year's work of only one factory. And there are other plants in Russia also producing lathes.

Take the new factory at Razan, about 120 miles outside Moscow. Initial production will be 2000 large lathes a year (47.24-in. swing over bed, 10-ft between centers). The director of the plant believes that he eventually can get production up to twice that number, or 4000 a year.

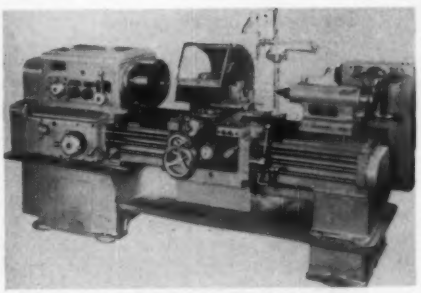
Go on down to Odessa on the Black Sea, a long plane flight from Moscow. Here is a plant devoted exclusively to making 4-ton radial drills. Some 2000 of them a year. And the plant director says that the single production line off which they come has nowhere near reached its full capacity for turning out radials.

Measure this performance, which utilizes practices heretofore unknown in machine tool building, against the output of machine tools in the United States and Great Britain. In 1956, U. S. lathe makers produced 12,194 lathes of all kinds and sizes, or just about the number turned out in the Krasnoi Proletarii plant in Moscow. In Britain, 14,407 lathes were built in 1951, the latest year for which figures are available. During 1956, U. S. radial drill builders shipped 1088 machines, whereas at Odessa the Soviets are already turning out 2000 a year.

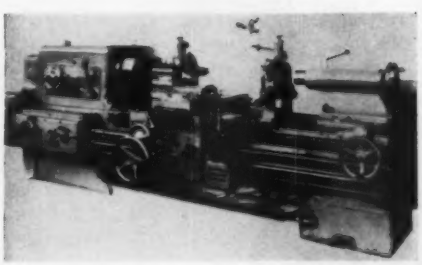
Yet the Russians claim it takes only 18 months from drawing board to actual production on such a line, including design and manufacture of needed special machines, and sometimes the buildings to house the line.

It's capable of turning out:

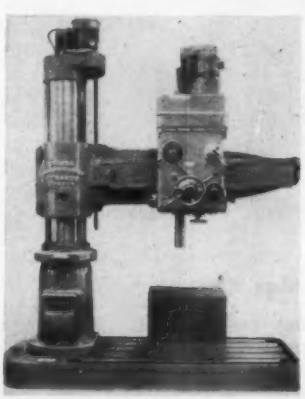
• . . . 12,000 of these small, high-speed universal production lathes a year — that's something like four an hour — in a single plant



• . . . and somewhere between 2000 and 4000 of these bigger (3 meters between centers) lathes a year in a new plant at Razan



• . . . and 2000 4-ton radial drills like this one per year on a single line that has "nowhere near reached its capacity"



How is it possible to get and then maintain such a phenomenal production rate? Perhaps there are two reasons. One is the tremendous driving force from within that seems to impel all workers, from the Director down to the sweeper, to press on toward attainment of greater and greater production volume. The other is the use of conveyorized assembly, such as one finds in any up-to-date auto plant.

Take the Krasnoi Proletarii plant. One of the oldest Soviet plants, it has been turning out machine tools for less than 30 years, specializing in two types of lathes: standards and specials.

At the time of my visit, the lathe production line had just been changed over to a new model, and other alterations were in progress.

Conveyors Speed Output at Krasnoi Proletarii . . .

The Russians are so shop-proud they put boardings around any major reconstruction in the shop. They also must work under a government decree that new building (brick and mortar) is prohibited.

It then becomes very difficult to design a line with an efficient layout in this already overcrowded plant, in which 1000 workers are on the lathe line and 3000 on special machines.

"Insurmountable" difficulties are a challenge the Russians seem eager to meet. During World War II, Krasnoi Proletarii was transferred to the Ural Mountains—down to the last screw. The plant was moved back one March after the war. By April it had already produced 25 lathes. The same speed of production planning goes on today. Changeover to the new model was made in November 1956. Last of the old models came off the line on October 27. By November 6, the first five new machines had been assembled. That meant installing, retooling and producing the first machines all within a 10-day period.

The new model, a redevelopment of the previous one, is classified by the Russians as a universal screw-cutting lathe. It has higher speeds, more power than the old model plus stepless speed variation. It accomodates work up to 18-in. dia, has speeds to 3000 rpm, through a mechanical friction-drive variator. Feeds range from 0.177 to 0.0008 in. per revolution. Drive is from a 14-kw motor. The lathe will produce all threads used in the USSR—including English, Continental, metric and module. The lathe itself as well as the production line was designed at the Krasnoi Proletarii plant, as were many of the special machines.

200 Manhours per Lathe

At Krasnoi Proletarii it takes about 200 manhours to build a lathe —or one complete lathe a month from every man working on the line. The Russians claim that because of their "true production-line technique" they can build the equivalent of a $7000 American lathe for about $3000. Whether or not that price includes payment for the services of government-owned machine-tool research that went into the lines and products could not be determined.

Here is a quick walk around the Krasnoi Proletarii lathe line:

Apron castings are drilled on a multi-spindle drilling machine designed and built at the plant. Unit heads carry out all the drilling, boring and tapping operations required on the casting, from two sides. Castings are fed to the operator on an ordinary roller conveyor, machined, and moved on another roller conveyor. Operating cycle is automatic except for loading and unloading, and a hydraulic lift is provided by the machine. When operator loads a casting onto the lift, a lever brings it up to machine height. Cycle time on this machine: 2 min.

Another multi-drilling machine carries out all drilling and ancillary operations on other castings, employing a centrally mounted drum indexing fixture, which brings components into position for duplex drilling operations from multiple heads.

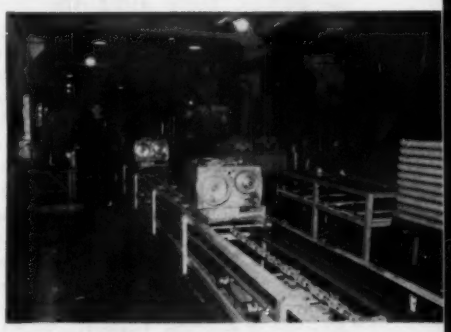
Special Milling Setup

Face milling of apron castings is done on a seven-spindle special milling machine setup. Castings are pneumatic-clamped in line, with each casting clamped independently by lever. Two large-diameter side and face cutters mounted on a spindle in the left head, and supported from an overarm on the right-hand head, carry out a straddle-milling operation. The other two cutters are mounted on the main spindles and face mill the ends. Inserted tooth cutters are used. Two main spindles do vertical milling, while two others set at an angle, do angular undercutting and slotting. Output is 40 castings per shift.

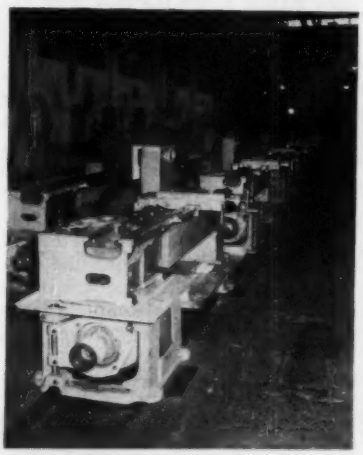
Two other special milling machines do the overall machining of the base. Roughing is done on one machine, and casting is finish-milled on another. In roughing, two cutters on an auxiliary horizontal head machine one side of the casting, while two angular and two vertical heads mill the faces of the slideways. The other two faces are milled by a cluster of cutters mounted on a horizontal arbor on the other side of the machine. Another cutter on another horizontal head mills surfaces on the second side of the casting.

An opposed-head duplex machine bores the headstock castings. Two components are mounted side by side and roughed and finished by the same machine by indexing the fixture. A number of verticle indexing machines, built at the plant, are used for such operations as multi-drilling of covers, machining levers and pulleys.

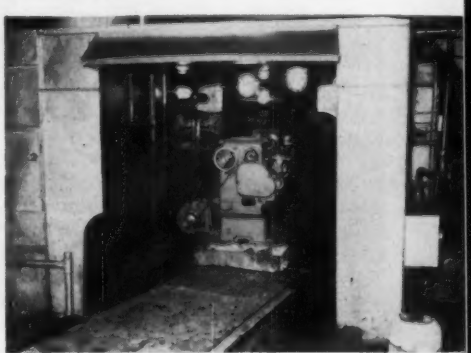
The assembly and painting sec-



Headstock conveyor is a chain-driven platen type. At end of line, headstock is lifted off by overhead hoist



Lathes enroute from main assembly conveyor to Krasnoi Proletarii's test and inspection line



Closed loop conveyor takes "dressed" lathes into the first of three spray-painting booths, then to shipping

RUSSIA (continued)

tions have four separate conveyors: one for headstock assembly, two for sub-assemblies, and one to carry the lathes through spray painting. Headstock conveyor is the platen type, driven by a chain. Headstocks, placed on platens, move along the conveyor rail. At the end of the line, each assembled headstock is lifted off its platen by an overhead hoist and transferred to a bench on the other side of the gangway, where it is run up and tested through the gears. Between-machine and between-operation handling is poor by comparison with the rest of the line—such as a slinging operation to move the headstocks from the assembly line to the testing section.

Empty platens return to the beginning of the line, traveling upside down along a floor-level track just under the assembly track. The headstocks take about 15 min to pass each station along the line, with the conveyor moving continuously. Actual output is 40 assembled headstocks per shift. After testing, headstocks go by roller conveyor to the final assembly line. The other subassembly conveyors, which are similar in operations, also converge onto the same line, which is so long that it literally disappears into the distance, and it is full of lathes. I counted 25 positions along the conveyor, and I think there are many more than that. One complete lathe comes off the line every 15 minutes.

Main Conveyor Indexes

The main assembly conveyor operates on the indexing principle. When it is idle, the machines rest on the floor, straddling the conveyor so that it is only loaded when transferring. Every 15 minutes, the conveyor carries all the machines forward one station. A jacking system lifts the conveyor, raising the machines slightly off the floor and moving them forward. Conveyor then stops, is lowered into its static position, waits 15 minutes, then goes on. Conveyor thus moves only the distance between stations, always returning to its original position.

The test section, primarily because of plant layout difficulties, is not conveyorized, so machines have to be lifted into the test section by sling and out again onto the conveyor that leads into the spray-paint area. Aside from headstock and final inspection, little testing goes on at Krasnoi Proletarii, or in any other Russian tool plant, for that matter.

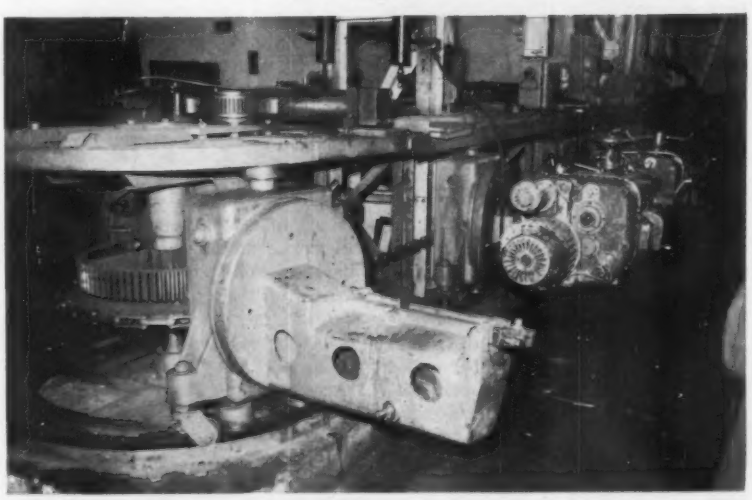
Plastic sliding surfaces are used throughout . . .
on lathes produced at Razan. Russians say plastic slides are completely reliable and that no accuracy is sacrificed. Shown here is the saddle with plastic sliding surfaces in position

Because of plant layout troubles, the lathe does not go straight through from dressing to painting. Instead, the paint section is on the floor above, and a conveyor takes the dressed machines to a lift. Then a closed-loop conveyor takes them through three painting booths, and then to the shipping department.

It is interesting to note that the Krasnoi Proletarii line has been copied and is now in production in Communist China.

The lathe plant at Razan, about 150 miles from Moscow, is brand new, and is just now getting into production. It has three main shops, including a new setup for producing a new model of lathe. In all, Razan employs 5000 workers—1200 of them on the new line. Like Krasnoi Proletarii, Razan turns out quite a few special machines, but its principal product is a new 4½-ton lathe with a swing of 47.24 in. This lathe can be produced on one line with a choice of 60, 80, or 120 in. between centers. It has a standard range of 24 speeds up to 1250 rpm, but this can be increased to 2000 rpm with change gears. By comparison with the smaller Krasnoi Proletarii model, Razan's lathe is underpowered, using the same 14 kw motor. The Raz-

Conveyors are the secret of



Radial drill heads are assembled . . .
on this mechanized, six-station closed chain-driven conveyor, which carries horizontal fixtures that project out from line at right angles. Trunnion mountings allow fixtures to negotiate radius at end of the line

an lathe can be fitted with a hydraulic copying device that is mounted in the rear of the machine and can be set for copy turning or facing.

A unique feature of the lathe is use of plastic sliding surfaces throughout. This has been done for some time on reconditioned machines in Russia, but this is the first time plastic slides have become standard on a new model. The Russians claim plastics can be used with complete reliability and with no loss of accuracy, and that on the contrary, plastics achieve high precision more readily, with a minimum of friction. Plastics gave the Razan people some trouble at first because of instability, but a system of preworking the plastic now makes it stable. Tests show that the plastic sliding surfaces wear only 0.0001 in. per 1000 working hours, and that under normal conditions it need be replaced only once in 4.5 years.

At the moment, Razan plans to turn out about 2000 of these lathes a year, but that schedule may be doubled when the plant gets into full swing. The shop for producing these lathes has three lines, two of them side by side for machining, and the other for assembly—it's conveyorized. All three lines run the length of the shop. At the head of the assembly line, headstocks are assembled. The next section of the line assembles the saddle, and the balance is given over to main assembly and test.

Razan's production thinking revolves around this credo, "All manual work on the assembly line should be avoided, and this is even more important than handling between stations." The basic idea is to adopt automotive production techniques to machine tool output, but to maintain tolerances not achieved in auto production. Razan's lathes are basically the same as those of Krasnoi Proletarii, but because Razan is newer, its lathe has improvements in details such as plastic ways. Soon, when all bugs are ironed out, testing, painting and final test will all be included on the main assembly conveyor. Two test methods will be used: under actual load, and a hydraulic test rig. The line is so designed that, unlike the one at Krasnoi Proletarii, test failure of a machine will not hold up the entire line. Because the entire line at Razan is laid out from scratch and not a revamped one like that at Krasnoi Proletarii, layout is much more efficient.

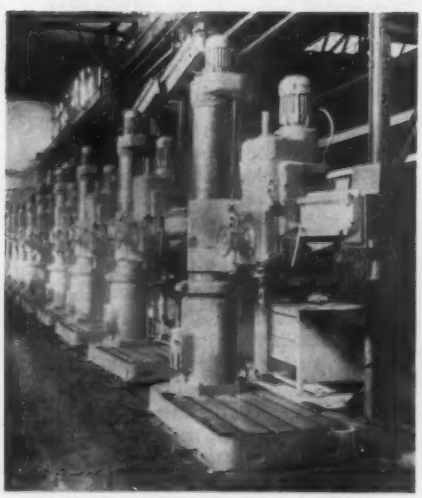
"Dry-Running" the Line

Even before Razan had a roof over its head, machines were set up in a spare bay in one of the other shops so that trainees could learn to operate them. In this way, a complete dummy line was set up and before the new building was completed, almost every machine in it was "dry run" on test components. Thus it became perfectly practicable to close the dummy line down on a weekend, transfer the machines to the new conveyorized line, and reach full output the next week.

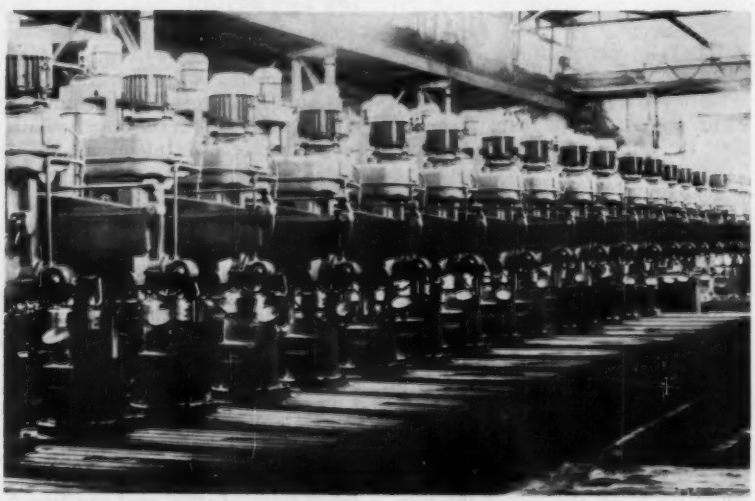
Some of the special machines at Razan: three 11-spindle special milling machines (built at the Gorki plant) for machining the three different base lengths of the lathes (total floor-to-floor time for overall machining of the 3-meter base will be 3 hrs, 50 min); two multi-head machines that carry out all drilling, boring and milling operations on the saddle, one to each side of the casting, in 12 min; a 7-spindle unit that does all milling operations on the apron casting, including grooving, in 5-6 min; a duplex double-head machine that mills two castings at once in 6 min; another duplex that mills all the holes in the gearbox in 12 min; a machine for turning tailstock bodies that has opposing heads, carries five spindles, and rotary-indexes parts through roughing, semi-finishing, finishing and grooving, and chamfering; special machines for grinding the inner taper of spindles; and vertical 6-station rotary transfer machines for use on gears, flanges, etc.

The Odessa radial drilling machine plant was bombed out, then moved to

high-production of radial drills at Odessa, too



Weight is a problem . . . on the main conveyor, where 9 radials are handled at once. Nose-to-tail lineup prevents toppling



This is the output of two days . . . at Odessa — about 20 radial drills. But how good are the machines? The Russians say visiting Swedish engineers wouldn't believe accurate machines could be turned out so fast, but "They saw them tested. Then they believed."

RUSSIA (continued)

the Urals in World War II, has since been rebuilt from the ground up on the original site. Today, it employs 2000 workers, including 288 engineers. Its production techniques are similar to those of Krasnoi Proletarii and Razan. It manufactures 15 types of radial drills in capacities up to 35, 50, 75, 100 and 140 mm, turning out 2000 of them in all per year. Annual output has increased from five radials in 1946 to the present 2000. The plant has 11 conveyorized lines, including subassemblies, the main assembly line, and the paint shop.

The heads for heavier models (with gearboxes) are assembled on fixtures that run on rails, but heads for other models are assembled on a closed-loop mechanized conveyor, which has six working stations on either side, and has horizontal fixtures that project at right angles. The fixtures are supported on heavy mountings with a trunnion on top that allows the fixtures to negotiate the radius at each end of the line. Fixtures run between rails on the base of the conveyor unit.

Assembly is progressive around the conveyor, so that the finished assembly returns to the loading point for unloading.

The main assembly conveyor operates on the same step-by-step principle as that described at Krasnoi Proletarii, indexing one station per hour. Sequence of assembly: (1) machine base, (2) column is added, (3) radial arm is assembled, (4) head is assembled, (5) electrical components are added, (6) and (7) final assembly on head and other details, and (8) finishing.

Then assembled machines are transferred to another conveyor, at right angles to the main assembly line, for painting. It takes a machine 1 hr to go through spray-painting.

Testing is cursory, to say the least. Take a machine with a capacity of 2.76-in. dia, with speeds from 11 to 1400 rpm. Complete test consists of making the machine drill through a test piece at 112 rpm spindle speed with a feed of 0.049-in. per revolution. This sort of thing seems to be standard throughout Russian's machine tool industry, where the attitude toward inspection seems to be that every man along the line is responsible for the quality of his work and that if the components are right, and assembly is right, the finished machine is bound to be right.

Craft Vs. Production Union Dispute Embroils AFL-CIO Coalition

MIAMI BEACH, FLA—Rival labor organizations are lining up for an all-out battle over job territories in manufacturing plants.

Sparked by a mushrooming dispute between the Sheet Metal Workers and two powerful industrial unions—the United Auto Workers and the Steel Workers—the contest lines were drawn up at the AFL-CIO Executive Council session here. The dispute was dropped into the lap of the top-level meeting for solution, but that action only seemed to fan the flames.

The Rift Widens

The craft-versus-industrial split that has marked the labor movement, even despite the AFL-CIO merger a year ago, has been intensified in growing jurisdictional arguments over construction work in manufacturing plants. The general line of demarcation that gives the industrial unions maintenance construction, and gives the building trades unions new construction is so fuzzy that it serves only to start arguments.

At the AFL-CIO session, the building trades unions threw their support behind the Sheet Metal Workers, making the contest a testing grounds for the whole issue.

The Burt Boycott

For the last several months, the Sheet Metal Workers have been boycotting products manufactured by the Auto and Steel Workers' unions, arguing that the craft union should be producing sheet metal as well as installing it.

The key dispute is still going on at Burt Mfg Co, Akron, Ohio, which has been organized by the Steelworkers for 10 years. The Sheet Metal Workers union is refusing to handle Burt's products because it doesn't represent Burt employees. The battle has cost Burt about $500,000 so far.

The Sheet Metal Workers are also fighting the Steel Workers at other manufacturing plants, and with the Auto Workers at DeVilbiss at Toledo, Jabez Burns & Son on Long Island, Anenostat at Hartford, Conn, and Woodall Industries at Mineola, NY.

The contest between the small craft union and the two industrial union giants is basically an outgrowth of failure to settle the craft-industrial union disputes. The Sheet Metal union argues that the industrial unions are doing craftsmen's work but at lower rates, and that such jobs should be turned back to the small craft unions. The Burt case is the key. Although only 240 employees are involved, the feeling is that if the Sheet Metal Workers win out here, they'll try it elsewhere. If they lose, it's all over.

Steel Workers' President Dave McDonald took the dispute to AFL-CIO President George Meany and the Executive Council, but the split between the industrial and craft unions was too serious to allow for such easy settlement. A bid by Meany to settle the overall jurisdictional fight over plant construction has been rejected by the building trades unions, too.

Turn Down Meany Proposal

Meany offered the proposal at the sessions here, offering to arbitrate both disputes. But at the same time, his proposal also would ban one union from boycotting another. This would hit directly at the Sheet Metal Workers' boycott on Burt products. If they had accepted Meany's program, the sheet metal dispute would have ended.

Abrasive Wheel Safety Code Revised, Simplified

CLEVELAND—The first major revision since 1947 of American Standards Association's Safety Code for "The Use, Care, and Production of Abrasive Wheels" is now available from ASA. The revision was made under the sponsorship of the Grinding Wheel Institute and the International Association of Governmental Labor Officials. Its most important change is to a new two-column format, in which code regulation material appears in the left-hand column of each page, with the right column containing an explanation of the corresponding Code regulation in simple language. Drawings and halftones in the right column are designed to assist in understanding the Code's provisions.

Symington Report Flays US Defenses

—Political Football or Stitch-in-Time?

WASHINGTON—New Congressional pressure for a big boost in production of military goods shows up in a report from the Senate Armed Services Subcommittee, headed by Senator Stuart Symington (D, Mo),—which investigated the adequacy of the Eisenhower Administration's airpower program last spring.

Although the report makes no specific recommendations for a step-up in output of aircraft and guided missiles and in weapons development, its conclusion is clear: the Defense Dept is not spending enough —or for proper programs to maintain military superiority over Russia.

During last year's investigation, Air Force generals charged—and Defense Secretary Wilson denied—that Russia leads the US in production of jet planes and is making faster technological advances than this country, that Russia's long-range striking power will be superior to ours by 1958-60 under current production schedules, and that vital military research projects are being held up for lack of funds.

The Symington Report backs up these charges, outlines wide-ranging criticism along the same lines of other programs, and concludes that "financial considerations have often been placed ahead of defense requirements, to the serious damage of our airpower strength relative to that of Russia; and hence to our national security."

Just as last year's Symington hearings influenced Congress to tack on $900 million to the Air Force's fiscal 1957 appropriation—to speed up aircraft and missile programs—it can be assumed that the new report will bolster efforts to push production of B-52 bombers, KC-135 jet tankers, and ballistic missiles up to higher rates next year. The Symington Report claims that bomber and tanker production is being kept below full-capacity level output.

Wilson has already told the House Armed Services Committee that military spending will go up at least $1 billion in fiscal 1959—that's on top of the $2-billion increase estimated for fiscal 1958—because of the growing production of costly new weapons. He said continued hikes in military spending are likely until a real disarmament scheme is developed—something the experts do not sincerely expect in the near future.

At the same time, Wilson tried to knock down talk of US military inferiority, said that the US has "military forces of tremendous striking power which in my opinion adequately provides for our national security at this time."

The Findings

These are the Symington Report's major findings:

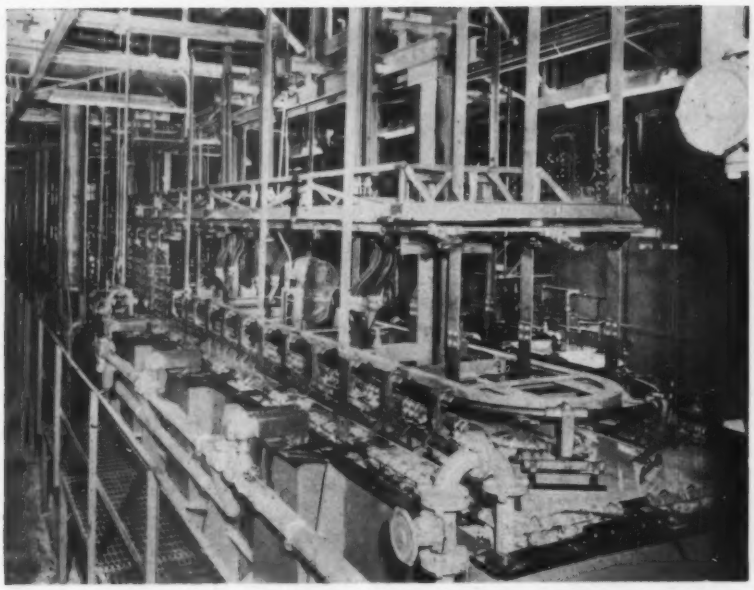
- Russia is producing more heavy jet bombers than the US, but if "adequate funds" were provided, "these limitations could be removed and our present estimated strategic air superiority maintained." Factors now limiting US strategic airpower: lack of technical personnel, modern jet tankers and long-range jet bombers, and dispersed bases.
- US air defense is "inadequate" because current fighter-interceptors cannot fly as high as latest Russian bombers and because of gaps in the radar warning system.
- The growing shortage of skilled Air Force technicians is creating a high aircraft accident rate and results in "our inability to maintain a proper state of alert against possible attack." Housing and pay scales are cited as causes of the manpower problem.
- Naval airpower cannot be expected to take up the slack in the "decline" of the Air Force's strategic striking power.
- "Direction and planning of naval strength again leaves the US vulnerable to submarine attack against our shipping and particularly vulnerable to submarine missile attack on military and civilian targets within our heartland."
- While our "qualitative lead" in aircraft is presented as justification for allowing Russia "quantitative" superiority, the Soviets are rapidly closing the qualitative gap. Russia leads in rate of technological development, training of scientists and engineers, and speed and quantity of prototype development. Duplicating military research projects and "dollar limitations" have held back US development of planes, missiles, and other weapons.
- It's essential that we be prepared for both limited and unlimited wars. But "confusion and inefficiency in defense planning have developed from vacillating policies . . . of emphasis." There is insufficient airlift capacity to maintain the army's mobility—there would be "great difficulty in lifting and properly supporting even one division overseas."

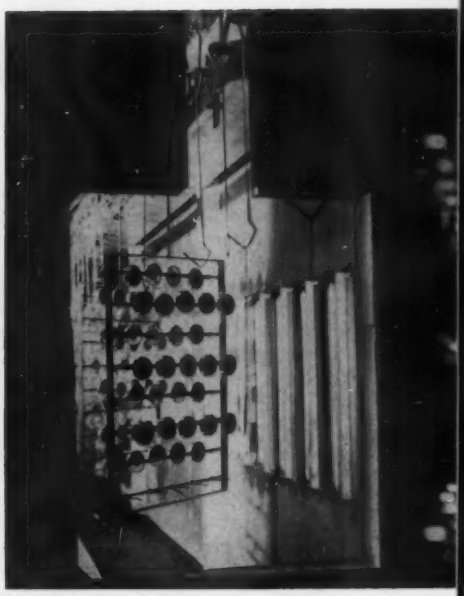
The report is signed only by the committee's Democratic members, Symington, Senators Henry M Jackson and Sam J Ervin Jr. The only Republican member still in the Senate, Leverett Saltonstall, submitted a lengthy minority report challenging Symington's conclusions and "objectivity." He says the majority report "takes an unduly pessimistic view of the state of our defense today and of our planning for the future." Former Senator James H Duff, an original committee member who was defeated in his bid for reelection, backs up Saltonstall's comments — which presumably reflect the administration's view of the Symington critique.

The Republican Senator claims Symington's report does not give enough weight to the testimony of civilian Defense Dept officials.

Even more significantly, he argues that it confines its analysis mostly to the years since 1953. "Where we are today," Saltonstall says, "is inextricably bound up with the nation's defense effort made over a much longer period of time." This is an obvious dig at the Truman administration's rapid demobilization after World War II and the policy of reducing military money requests an average 33% annually during the Korean War—compared to Eisenhower's average 13% cutback.

Concludes Saltonstall: "Our air power and naval strength, together with our ground forces, make us superior to the Soviet Union today . . . (but) we can never engage in a numbers race with Russia . . . what we do want are balanced land, sea, and air forces which give us a visible deterrent and such power to retaliate quickly and devastatingly that no enemy would dare to attack us."





High-Speed Automatic Finish for Die Castings

This automatic finishing setup for die castings is part of a $500,000 installation at Precision Castings Co, Syracuse, N Y, that includes automatic equipment for cleaning, copper-nickel and chrome or brass plating, phosphate coating, electrostatic spray painting, baking and polishing. Features of the line include a multi-station cleaning cycle in which cleaning and plating units are on separate conveyors so cycle times can be controlled independently; and a plating setup that allows duplication of any copper-nickel-chrome plating requirement. Unit can handle any die casting from 1 sq in. up to 14 x 36 in., at up to 140 racks per hour. At left is overall view of plating machine. Right; die-cast TV tuning knobs are exposed to infra-red tubes to bring them up to baking temperature fast. This method gives equivalent of a 30-minute bake in 20 minutes

$33-Billion U S Highway Program Bolsters Construction Equipment Market

WASHINGTON — Construction machinery builders have been given a solid look at what to expect in the way of new orders stemming from the big $33-billion Highway Program —and prospects are bright.

American Road Builders' Association recently told a Congressional committee that an additional 70,000 major pieces of construction equipment, costing about $1 billion, will be required over the next five years for the project.

This is over and above present machinery that will come up for normal replacement (average life of such equipment is seven years). Total demand for machines that will arise in the 13-year building period is estimated as high as $2.6 billion.

To meet demand occasioned by the Highway Program, output of construction equipment will have to be increased 17 to 25% in the next few years, when demand will be greatest. As much as two-thirds of equipment needs for the next five years will have to be met within the next two years. Manufacturers won't necessarily have to expand plant capacity, but it could mean doubling, or even tripling of plant shifts.

Needed: Steel Priorities

The construction machinery picture does have a few dark spots at the moment, though, such as a shortage of earthmoving equipment, but this should be ironed out soon. Too, the suppliers of equipment for the Highway Program must be given a high priority for steel and other needed raw materials.

New equipment developments may be given a freer rein in the Highway Program, too, if the Program's administrators will break with traditional specifications and will encourage new construction techniques—such as writing specifications around results and allowing the contractor a greater choice of methods and equipment.

One example cited by General Louis W Prentiss, executive VP of the American Road Builders' Association: "An equipment manufacturer recently developed a new paving machine that can finish paving at almost double the speed provided in earlier specifications.

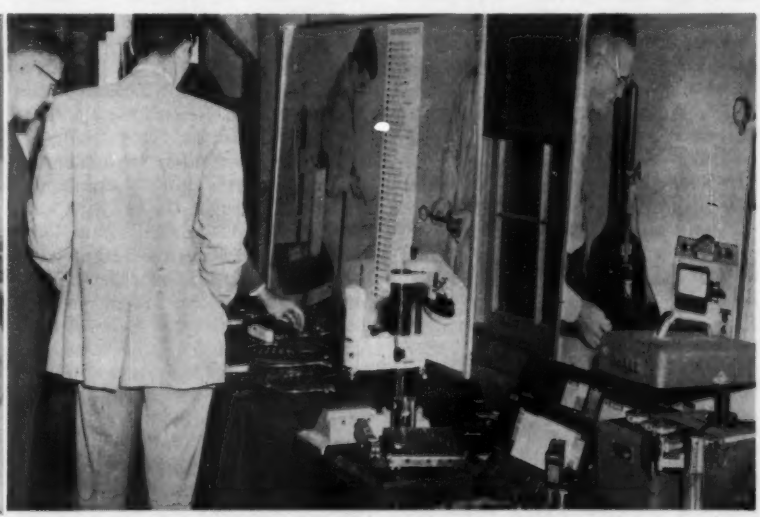
"He will now be required to go to the expense of demonstrating to each highway department his new machine in order that the specifications may be changed. It would appear that if satisfactory performance on a federal aid project is demonstrated in any one state, the Bureau of Public Roads should be able to authenticate this performance to all states."

South...

About the South . . .
Talk is that Dade County, Fla, will soon have a cargo plane manufacturing plant that may employ up to 3000; no confirmation as yet . . . And an undisclosed northern firm is considering construction of a $15-million industrial plant in Atlanta, Ga . . . **Simonds Saw & Steel Co** is putting up a 40,000-sq-ft warehouse, sales office, and service shop in Shreveport, La; it'll be ready for spring occupancy . . . **Temco Aircraft,** Dallas, has a $16-million Navy order to design and develop a new guided missile weapons system. Company is building a 100,000-sq-ft office building at its Garland, Texas, plant, will move company offices from the Grand Prairie facility to Garland during the summer. Engineering dept will be transferred to a new center there in July . . . **Walker Tool & Engineering Co** has bought a 3.5-acre site for its proposed new plant in Atlanta . . . **New England Industries** is about to start on a $3-million expansion of its High Point, NC, facilities; project will more than double company's present High Point investment . . . Fourth metalworking manufacturer to announce a new plant in South Carolina during the past 12 months is **Hartford Machine Screw Co,** Conn; it'll invest more than $400,000 in a facility to manufacture textile machinery parts in the Greenville area . . . **Parkersburg-Aetna Corp,** Parkersburg, W Va, has established a separate Metal Buildings (pre-engineered units) Division as part of its Rig & Reel Co Div . . . Shelby, NC, is about to get a $20-million **Pittsburgh Plate Glass Co** plant; tentative plans call for fall construction of a fiber-glass facility to be completed in 15 months . . . **Miami National Container Co,** subsidiary of National Container Corp, has just begun production in its new 110,000-sq-ft plant in Miami . . . **Stein Steel & Supply Co,** Atlanta, has completed a 6,000-sq-ft plant for fabricating bar joists and other types of structural steel.

East...

Eastern briefs . . .
Jones & Lamson Machine Co, Springfield, Vt, has opened a Boston district office at 751 Main St, Waltham; it'll handle sales and service of machine tools and optical comparators . . . New **Instrument Gage Division** has been set up by **Taft-Peirce Manufacturing Co,** Woonsocket, RI . . . **Sossner Tap & Tool Corp** of Lynbrook, NY, has expanded heat-treating operations to incorporate triple tempering of all Sossner taps . . . **Minneapolis-Honeywell** has consolidated operations of its Doelcam and Transistor Divisions into a single unit to be known as the Boston Division. Production will be centered in the recently purchased 250,000-sq-ft plant in Boston . . . **Sikorsky Aircraft Division** of United Aircraft, Stratford, Conn, has designed a new helicopter to carry 17 to 20 passengers. Amphibious craft will have two GE T-58 turbine engines on top of pilot's compartment. Sikorsky will try for military contracts before turning to commercial production . . . **Allegheny Ludlum Steel Corp** has announced increases ranging from 6 to 15.5¢ per lb in base price of special high nickel electrical alloys. Jump reflects higher cost of nickel and other raw materials . . . **Daco Machine & Tool Co,** Brooklyn, has changed its name to **Daco Instrument Co** because it has been concentrating for the past ten years



Traveling "Progress Through Measurement" Exhibit

The history of measurement—from Stone Age man to modern precision devices—is the subject of an exhibit sponsored by the Wilkie Foundation, DesPlaines, Ill, currently touring the northeastern states. It's the second in a series designed to show man's progress through use of tools. The combined educational exhibit and lecture is being held at engineering and technical society meetings. At left is shown the first standard of measurement, the cubit, which was based on the length of the arm of an Egyptian Pharaoh who lived some 5000 years ago. At right; visitors are encouraged to handle and operate the modern precision measuring instruments displayed

FIELD REPORT

Most powerful gearset . . .
ever designed and built by Michigan Tool's Cone-Drive Gears Division has a running torque rating of 20-million in.-lbs. It's installed in a 1500-ton stretcher built by Lombard Corp at its Youngstown, Ohio, plant

$1-million fire in sub-zero weather . . .
This is how Midland Steel Products Co, Cleveland, looked the morning after a five-alarm fire on January 16. Damages included total loss of the main paint spraying and drying conveyor system, one third of the loading dock area, destruction of the overhead loading crane runway. The effects of the shutdown would have been felt in Detroit, Flint and Pontiac, where Midland is a major supplier of automobile frames, except that the company had anticipated such an emergency by installing an alternate painting line in another section of the plant

on manufacture of electro-mechanical instrumentation. Makes sense . . . Cash awards for the Second Annual Allmetal Stainless Steel Awards will be increased this year to $1500. Sponsored by **Allmetal Screw Products Co,** Garden City, NY, prizes will be given for the best case histories describing use of stainless fasteners as cost-reduction factor in product manufacturing. Entry blanks can be had from the company at 821 Stewart Ave, Garden City, LI, NY; deadline for entries in June 1 . . . **Erie Forge & Steel Corp,** Erie, Penna, has begun a $4-million expansion program that will include addition of a 75-ton electric furnace. Second unit of the same size, plus a 15-tonner will be added later, doubling Erie's capacity, presently rated at 234,000 net tons a year.

Midwest...

Midwest notebook . . .

Mattison Machine Works, Rockford, Ill, has purchased the line of production grinders built by **Mercury Engineering Corp,** Milwaukee; acquisition includes tooling and component parts already made. Grinders are custom-built, but Mattison plans to standardize at least 50% of components . . . **Fawick Corp,** Cleveland, has acquired exclusive patent rights and license to manufacture and distribute magnetic clutches made by Wilhelm Binder, Germany. All parts of the Fawick Magnetic units will be made to American specifications in the Cleveland factories . . . **Dodge Division of Chrysler Corp** has orders already for more than 1200 air-conditioned cars. Only 1332 Dodges were so equipped during all of the 1956 model run. Reason for upswing: sharp reduction in price, and new combined heater-air conditioner mounted in the engine compartment . . . **Solar Aircraft Co** has a $1,300,000 AF contract to build components for the J75 jet engine designed by Pratt & Whitney. Solar's Des Moines plant will make components in production quantities for Ford Motor's Aircraft Engine Division which is manufacturing J75's under license from P&W . . . **Sundstrand Machine Tool Co, Rockford, Ill,** has taken over assets and liabilities of its wholly owned subsidiary, **Sundstrand Magnetic Products Co,** will carry on dissolved company's former business . . . **Cleveland Brass Manufacturing Co** has purchased a 50,000-sq-ft plant at Kinsman, Ohio, will transfer operations there by the end of March . . . **General Motors** is delaying initial construction work on its projected Chevrolet assembly plant at Lordstown, Ohio. Spokesmen say size and required utilities have had to be reconsidered. Scheduled capacity was to have been 75 cars and 30 trucks an hour . . . **Hubbard & Co** of Pittsburgh and Chicago has acquired all outstanding stock of **Illinois Gear & Machine Co,** Chicago. **Illinois** is expanding its South Works plant to accommodate $2 million worth of new machinery . . . **Standard Transformer Co,** Warren, Ohio, has been sold to **American Gage & Machine Co,** Chicago, for an undisclosed sum . . . **General Motor's AC Spark Plug Division** happily reports record peacetime employment (18,700), new peak in replacement sales, sharp gains in military business . . . **International Research & Development Corp,** Columbus, Ohio, electronics firm, and **Hicks Corp,** Boston company engaged in mechanical design, machining, and fabrication, have launched a joint sales program for marketing a new line of high-speed aviation, missile, and rocket parts testing equipment. **Hicks** will use its two Boston plants and a new Asheville, NC, facility to manufacture the new products . . . Big-car plans and figures: **Lincoln,** expecting a hefty increase in sales this year, plans a better-than-100% increase for '58 models; **Buick** says production of Roadmaster and Super models for '57 is being upped to 32.6% of total output of Buick line, compared

Giant hammer at work . . .
at Westinghouse's Blairsville, Pa, plant is forging a huge stainless steel turbine blade under 475,000 ft-lbs impact. The 44-in.-long blade is one of 200 being forged for an advanced turbine for Philadelphia Electric

Bigger, more intricate forgings . . .
are the order of the day at US Steel's Homestead District Works, where the heat-treating and forging divisions have undergone extensive modernization. This is a 35-ton flange for a nuclear power reactor, shown being checked by a machinist before it leaves the division's new 20-ft vertical boring mill. The plant's largest forgings are machined into turbine and generator rotors, heavy machine parts, rools and sleeves, and plant maintenance equipment

to 29.3% a year ago; **Chrysler** Imperials are up, too—2203 were delivered in Dec '56, an increase of 91.4% over Dec '55 . . . **American Machine & Foundry Co's Leland Electric Co Division** has leased the 140,000-sq-ft plant formerly owned by **Standard-Thompson Co** at Vandalia, Ohio; it'll be used to consolidate production facilities for Leland's aircraft products . . . **Caterpillar Tractor** plans to build a 500,000-sq-ft plant on an 1100-acre tract in Peoria for manufacture of two large V-type diesel engines.

West . . .

Scanning the West . . .

General Motors Corp has indefinitely delayed plans for its Buick-Oldsmobile-Pontiac assembly plant in Sunnyvale, Calif. Original schedule called for completion in time for production of '58 models; last fall GM amended this to '59 models. Company says now "Plans are undergoing revision which will result in some delay in completion of the project." . . . **Convair,** San Diego, has placed orders for more than $1,220,000 worth of heavy machine tools to be used in building the Model 880, world's fastest jet airliner; capital funds for another $2 million worth of heavy tools and special equipment will be released shortly. TWA has ordered a fleet of 30 of these 609-mph aircraft, Delta has 10 on order; deliveries will begin late in '59 . . . More steel will be on tap for the West Coast; **Bethlehem Pacific Coast Steel Corp** has boosted total capacity of its three mills to 1 million tons of ingots annually, an increase of 50,000 tons over 1956 rated capacity. Expansion now under way at the Seattle plant will add another 175,000 tons when it's completed in '59 . . . Convair has received two AF contracts for all-weather jet interceptors. A $74-million order calls for an undisclosed number of F-102A's, its fifth for this plane; $70-million second contract for F-106A's includes supporting equipment . . . Ship repair industry in Portland, Ore, has just wound up its two busiest years in peacetime history, according to biennial report from the Port of Portland to the Oregon State Legislature. Portland firms did $50 million worth of ship repair and conversion work, mainly at Swan Island . . . **Lockheed Aircraft** has decided to let Prudential Insurance Co build its $14-million missiles systems division in the San Francisco Bay area. Prudential will acquire title to 83 acres of a 275-acre property Lockheed owns in Sunnyvale, will build 500,000 sq ft of facilities there and in Palo Alto and lease them to the company. Switch to Prudential ownership frees working capital for other expansion including nuclear work and production of the Electra propjet transport . . . **Roylyn Inc,** Glendale, Calif, maker of "Quick" couplings, coupling valves, tube unions, and allied products, has formed a new corporation, **Airaterra,** to develop and market Roylyn products as well as those of other manufacturers available on an exclusive basis . . . **Jonco Aircraft Co,** Shawnee, Okla, subsidiary of **Fairchild Engine & Airplane,** is expanding to fill long-term production contracts for the F-27 twin engine turbojet commercial airliner. New production will increase present monthly payroll of $120,000 to $500,000, will triple its 300 worker force . . . **Mare Island Naval Shipyard,** Vallejo, Calif, expects to start fabricating sections of the newly-assigned "tear drop" nuclear submarine by year's end. The SSN-588 will be the third nuclear sub under construction there this year . . . **L A Young Spring & Wire Co's** plant in San Leandro, Calif, is turning out aluminum honeycomb core as result of firm's purchase of machinery and manufacturing rights to the product from **Flexo Mfg Co, Los Angeles.**

Ervin J Baumrucker has been appointed general sales manager of Clearing Machine Corp, Chicago. He was formerly Detroit district sales manager

J Herbert Myers has joined the executive staff of Cincinnati Shaper Co. He has been associated with the machine tool industry for the past 38 years in various capacities

Frank J Rossmann has been appointed assistant to the vice president, Field Sales Division of Giddings & Lewis Machine Tool Co. He was formerly associated with Cincinnati Bickford Tool Co, a G&L division for the past year

Names in the News . . .

Harold E Torell has been named executive vice president of the Syracuse Supply Co, Syracuse, NY, a newly-created position. With the company since 1925, he will coordinate activities of the three operating divisions while continuing as director of the industrial supply division. **Frederick B Scott,** who will continue as president, will devote more time to the company's expansion plans and future financial requirements. **David R Powers** is now heading the production, power tool, and abrasive group of the Syracuse Supply Co's supply division. **W Earl Forsthoff** has charge of the power transmission, materials handling, and engineering groups, and **M G Wilson** of the general supply, maintenance, and contractors' supply group. **Philip B Scott** is manager of the company's Schenectady, NY, branch, and **Charles Nolan** of the Massena, NY, branch. **Earl B MacDonald** will continue as operating vice president of the machine tool division of the company.

Alphe G Jarreau, sales manager of the Barden Corp, Danbury, Conn, has been named vice president of the company.

Herbert R White, vice president of Eclipse Counterbore Co, Detroit, has been elected president and general manager to succeed **Roy G Michell,** named chairman of the board. **I A Homrich** has been appointed vice president, manufacturing, and **Austin P Smith,** vice president, engineering.

Joseph Friedman, formerly executive vice president of US Hoffman Machinery Corp, has been elected president of Chromalloy Corp, White Plains, NY. **Harry Harris,** former president, has been named board chairman.

Hugh V Allison, president and general manager of the Allison Division of American Chain & Cable Co, Bridgeport, has also been appointed to the newly-created post of general manager of ACCO's Campbell Machine Division.

Albert L Hollinger, vice president of Surface Combustion Corp, Toledo, Ohio, has been appointed vice president, sales, of all industrial divisions of the corporation. **Donald K Martin,** formerly Pittsburgh district sales manager, has taken over Mr Hollinger's former duties as sales manager of the Steel Mill Division.

Rear Admiral William O Gallery, USN (Ret), (left) has been appointed vice president, administration, of Verson Allsteel Press Co, Chicago and Dallas. **Melvin D Verson**, assistant to the president, has been named vice president, marketing

Adolphe J De Matteo, chief engineer of Farrel-Birmingham Co's Watson-Stillman Press Division, has been named division general manager

Manuel F Diaz has been elected president of Wesson Tool Co. Named to succeed **Ernest Mortensen**, who has retired after 50 years in the cutting tool industry, Mr Diaz has been secretary-treasurer and a director of all subsidiaries

George E Hawkins, vice president of Air Reduction Co, has been elected executive vice president

Harry E Pinkerton, formerly manager of the Engineering Applications Division of Airborne Instruments Laboratory, has been named president of Intercontinental Electronics Corp, Mineola, NY, firm organized last year to manufacture and market electronic developments of France in the US

Selby F Greer and **Francis P Healy** have been elected directors of Van Norman Machine Co, Springfield, Mass. Mr Greer is president of Van Norman Automotive Equipment Co; Mr Healy is vice president.

C E Russell, works manager, has been appointed vice president, manufacturing, of J B Beaird Co, Shreveport, La, manufacturer of heavy steel products. Beaird Co merged with American Machine & Foundry Co last December.

B H Stenberg, works manager of Crane Packing Co, Morton Grove, Ill, has been promoted to vice president, manufacturing. Additional appointments: **Vance E Vorhees,** assistant general sales manager to vice president, sales; **E H Stubenrauch,** divisional sales manager, to succeed Mr Vorhees.

John A Coe, president of American Brass Co, Waterbury, Conn, has been elected to the board of directors of The Bullard Co, Bridgeport. He fills the vacancy created by the death last September of **Joseph W C Bullard,** retired former vice president of the company.

F W Dorenbos, in charge of the hydraulic press division of Clearing Machine Corp, has been named assistant chief engineer for the entire company.

Frank K Gardner, vice president and general manager of R MacDougall Co, Galt, Ont, has been elected 1957 president of the Canadian Machine Tool Builders Association.

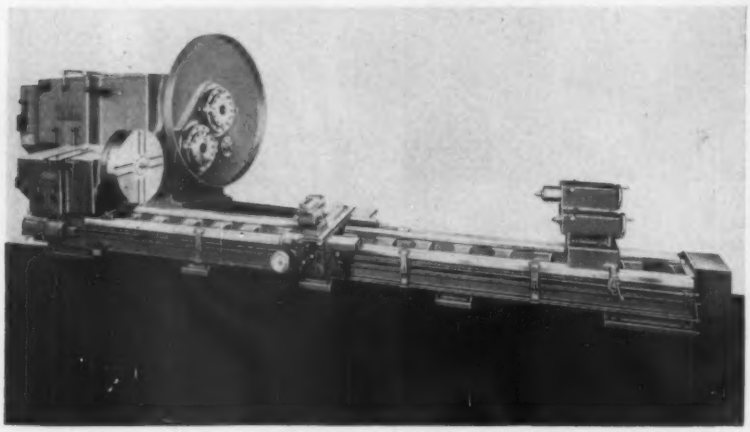
John Comstock has been named sales manager of Ready Tool Co, Bridgeport, Conn.

Charles S Rockwell has been named vice president and general manager of the Ford Instrument Co Division of Sperry Rand Corp. He has been serving as vice president and works manager of the Sperry Farrugut Div

Carl E Schmitz, vice president, sales, has been named executive vice president of Crane Packing Co (additional appointments listed above)

L C Daniels (left) has been appointed general manager of the Buda Division, Tractor Group, Allis-Chalmers Manufacturing Co. He succeeds **R K Mangan**, president and general manager of the Division, who has retired. **Owen J Higgins** (right) assistant general works manager of the Tractor Group, has been named general manager of the Harvey, Ill, Works

New Shop Equipment



Boye & Emmes Dual-Spindle Lathe Turns Both Large and Small Work

Designed to provide facilities for turning both large-diameter and small-diameter work, dual-spindle lathe provides 60-in. swing over the bed with upper spindle and 40-in. swing with lower spindle. The two spindles are positioned within easy reach of operator; point of contact between work and tool is always within sight and reach.

One important feature of machine, company points out, is that operator can engage or disengage the various drives at will, protected by a mechanical safety-interlock arrangement which prevents machine-damaging movements. Work can be held stationary, for example, between the upper spindles while an attachment, mounted on the carriage, performs milling or grinding operations throughout the entire length of carriage travel.

Lower spindle is provided with 12 speeds between 6 and 250 rpm. Upper spindle has two ranges of 12 speeds, 3.6 to 150 rpm and 0.8 to 33.3 rpm. The upper spindle is always driven from the lower spindle. Both spindles are equipped with heavy-duty Timken bearings. With No. 7 Morse centers, lathe will turn rolls weighing in excess of 30,000 lb between centers on either spindle. 30 hp is available to lower spindle, the 6 higher spindle speeds of the upper spindle, and all speeds above 7 rpm when using face-plate drive on upper spindle.

The gear box can be driven from either spindle. An interlocking arrangement prevents accidental engagement of both spindles to the gear box simultaneously. This arrangement provides for two ranges of feeds and threads for each spindle.

Standard equipment furnished with each lathe consists of a pair of hardened and ground 60°-included-angle centers, small faceplate, toolpost, and wrenches. A complete line of optional accessories is offered. Bulletin 2513.

Boye & Emmes Machine Tool Co, 81 Caldwell Dr, Cincinnati 16, Ohio

Indirect-Arc Furnace Features Magnetic Amplifier Arc-Control

Pedestal-mounted Series P furnaces have magnetic amplifier arc-control system permitting variation in speed of the control motor so that its speed is directly proportional to unbalance.

Motor-driven electrodes are automatically controlled, and may also be moved by manual push-button controls during automatic operation. All switches, push-buttons and indicating lights are in a single box.

Capacities are from 350 to 4000 lb; kw ratings from 125 to 600.

Detroit Electric Furnace Div, Kuhlman Electric Co, Bay City, Mich

Sheffield Portable Cutting Tool Uses Ultrasonic Waves

Lightweight unit converts ultrasonic waves into high-speed mechanical oscillations making possible the precise cutting and machining of such hard and brittle substances as ceramics, porcelain and glass, as well as metals.

All sizes and geometric shapes can be handled. The harder and more brittle the material, the faster the tool penetrates. Process is effective only on extremely hard substances and harmless to anything resilient, such as an operator's hand or finger.

Sheffield Corp, Springfield & Thomas Sts, Dayton 1, Ohio

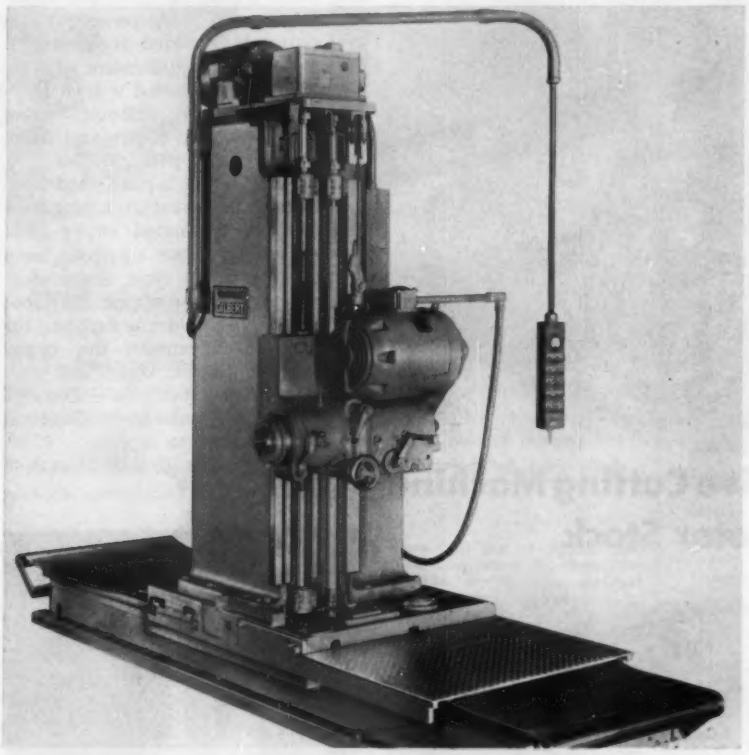
Jarvis Leadscrew Tapper Features Adjustable Pitch

Only one leadscrew is used to cut all listed pitches on precision leadscrew tapper available in two models: AP-9100 allows conversion from 11-pitch to 12, 13, 14, 16, 18, 20, 24, and 28-pitch in a matter of seconds; Model AP-9000 converts from 24-pitch threads to 28, 32, 36, 40, 44, 48, 56, 64, 72, and 80-pitch with equal speed.

A graduated scale indicating pitch settings is attached to a lever which controls vertical travel of the leadscrew follower and the tap. Four socket screws are loosened, adjusted, and then tightened to provide conversion from one pitch to another.

Jarvis Corp, Middletown, Conn

Materials and Parts . . .



Cincinnati Gilbert Floor Miller Handles Large, Cumbersome Work

Pendant-controlled milling machine, developed for milling the ends of structural-steel shapes and other such cumbersome parts, is provided with a wide range of horizontal and vertical travels: vertical travel of spindle head is 36, 48, or 60 in.; horizontal travel of column is 48, 72, 96, or 120 in.; and height of runway is 14 in.

Pendant station, on which a horsepower meter is mounted, controls the 20-hp main drive motor and the multi-speed feed motors. Adjustment to spindle is by handwheel, equipped with a dial reading in 0.001 in. Spindle speeds are 400-972-1620 rpm. Feed to the head and column is 30-40-60 ipm. Taper in spindle nose is No. 50 NMTBA Standard.

Column and head are heavily ribbed box-section alloy castings. Non-metallic ways are provided on head and column base. Column is guided on the runway, and the head on the column, by narrow guides with taper gibs; leadscrews are within the guides.

Machine features Bijur pressure lubrication to the head ways and automatic lubrication to the column ways. Head gearing and Timken spindle bearings are lubricated by a power-driven pump.

Cincinnati Gilbert Machine Tool Co, 3366 Beekman St, Cincinnati 23, Ohio

Firth Sterling Carbide Grade for Machining Cast Iron, Aluminum

Firthite NHA is recommended for machining cast iron, aluminum, brass and plastics. Material reportedly has excellent twisting and brazing qualities and, in a test on a piece of Dural-75 ST measuring 12 in. long and 2 in. wide, 10 milling cuts produced only a 0.005 wear land.

Firth Sterling Inc, 3113 Forbes St, Pittsburgh 30, Penna

...including

MACHINE TOOLS AND ATTACHMENTS

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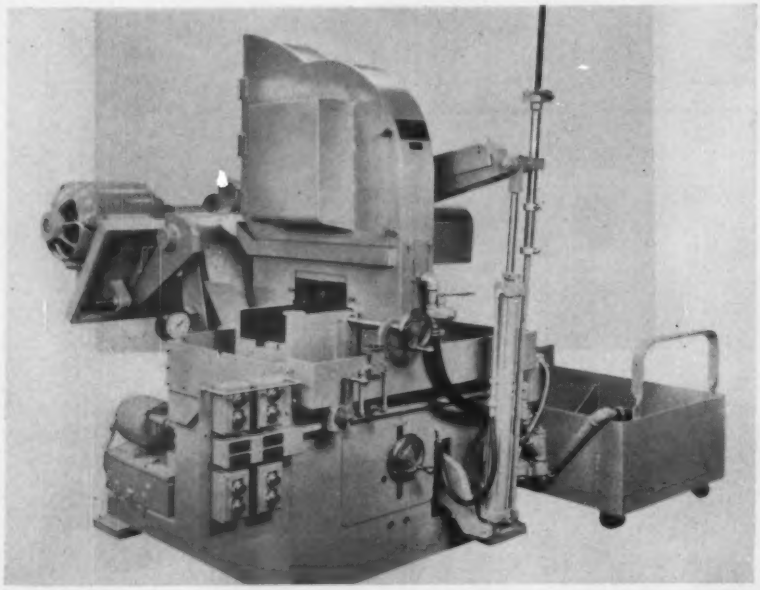


Campbell Wet-Abrasive Cutting Machine Handles Large-Diameter Stock

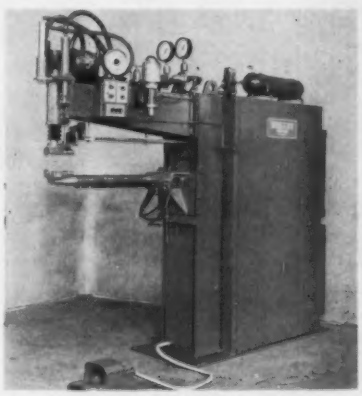
Model 481 wet-abrasive cutter will reportedly cut any metal within its capacity of 8-in.-sq solids. Large-diameter barstock, tubing, and other shapes can be accommodated on the unit, which cuts ferrous and nonferrous metals, including corrosion-resistant steel as well as hardened or annealed steels of practically all analyses.

Unit is an oscillating-type machine in which wheel feed and work clamps are hydraulically operated and work is hand fed. Through its oscillating motion, amount of abrasive-wheel contact is materially reduced and cutting is performed with a minimum of wheel pressure.

Main bed or pedestal is fabricated of heavily ribbed and welded steel and is constructed with a self-draining coolant collector. The forged-alloy spindle is mounted in a housing adjustable for accurate alignment. System of brackets, pulleys, and tension units enables any desired degree of tension to be applied to the belts and maintained regardless of the amount of load imposed by the cutting wheel.

Model is furnished with a 25-hp, 1800-rpm, totally enclosed motor to drive the abrasive wheel. Drive from motor to spindle is through multiple V-belts. Machine is 100 in. long, 85 in. wide, and 84 in. high.

American Chain & Cable Co, Inc, Campbell Machine Div, 929 Connecticut Ave, Bridgeport 2, Conn



Sciaky Seam and Spot Welder Handles Light-Gage Metals

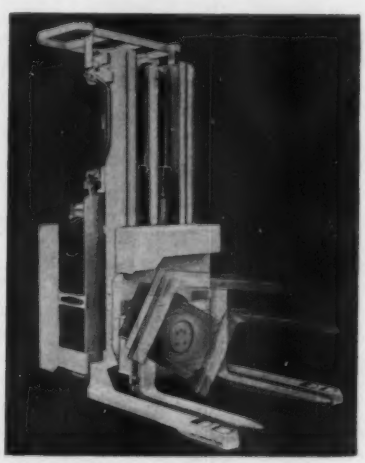
Model PMM-OC seam and spot welding machine is an air-operated, electric resistance unit capable of welding light-gage aluminum and other light alloys, stainless steel, titanium, and mild steel. Machine can weld metals as thin as 0.002 in. and as thick as 0.016 in.

Unit's pressure system is capable of exerting a maximum of 120-lb electrode force under an air-line presure of 80 psi. System is designed for accurate control of the low electrode force required and for rapid follow-up. Electrode force is controlled by pressure regulators equipped with pressure gages, and a back-pressure sytem permits attaining an electrode force as low as 38 lb. Welding stroke equals ¼ in. plus 3½-in. retraction stroke.

Welding transformer is designed for single-phase, ½ cycle uni-directional operation. A series-parallel tap switch is provided to extend the range of heat adjustment. Transformer is water cooled with a thermostatic-controlled solenoid water valve to prevent condensation. Main transformer is rated at 50 kva.

Welding current is conducted from transformer to the reciprocating electrode by a laminated shunt. For seam welding, upper electrode head is a silver-contact type; lower electrode head is of same type. For spot welding, upper holder is supplied for attachment underneath the upper seam-welding head. Upper and lower heads are rotatable to either side to permit transverse or longitudinal seam welding.

Sciaky Bros, Inc, Dept M-13, 4915 W 67th St, Chicago, Ill



Revolving Forks Adapt Electric Truck to Dumping Operations

Revolving forks can be mounted on any 4000-lb capacity Raymond Straddle Truck and will permit operations such as dumping small parts from steel boxes into hoppers. Normal position is used for stacking.

Revolving mechanism is powered by a hydraulic motor through a chain-driven sprocket and gear reduction. Forks rotate 360 deg in either direction and are controlled by a hand-operated hydraulic valve.

Oil pressure to operate revolving fork arrangement is developed by same motor and pump that powers hydraulic lifting device.

Raymond Corp, 47-147 Madison St, Greene, NY

FYI
FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 STRAIGHT SIDE PRESSES—*Baldwin-Lima-Hamilton Corp, Hamilton Division, Hamilton, Ohio.* 8-page bulletin 13300 illustrates, describes, and gives specifications for double and single crank units with capacities of 200, 250, and 300 tons. Both types operate at 23 to 36 spm (single geared) and 12 to 20 spm (double geared).

2 MILLING MACHINE — *Producto Machine Co, 990 Housatonic Ave, Bridgeport 1, Conn.* 8-page booklet gives information on the Index Mill-Matic, an automatic production unit with index mechanism built in horizontal worktable. Machine performs index, station, or combination milling. Typical tooling arrangements illustrated; design and construction features, specifications included.

3 DUAL-SPINDLE LATHE—*Boye & Emmes Machine Tool Co, 81 Caldwell Drive, Cincinnati 18, Ohio.* 6-page illustrated folder describes design features, lists specifications. Upper spindle has 60-in. swing over bed; lower spindle, 40-in. Lower spindle is provided with 12 speeds, 6 to 250 rpm; upper has two ranges of 12 speeds: 3.6 to 150 rpm, and 9.8 to 33.3 rpm; headstock motor has 30 hp.

4 UNDERDRIVE SQUARING SHEARS —*Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY.* 74-page bulletin 69G describes and illustrates features of 59-model line with shearing capacities from 16-gage to 1-in. mild steel, cutting lengths from 4 to 20 ft. Specifications detailed in tabular form.

● CHEMICAL MILLING—*US Chemical Milling Corp, 1700 Rosecrans Ave, Manhattan Beach, Calif.* Tooling requirements for the new process are specified in detail in Design Bulletin No. 8. Outlines three optional procedures for producing templets required to chemically mill flat or formed parts in aluminum and magnesium. Request direct on company letterhead.

5 DIE-CASTING MACHINES — *Hydraulic Press Mfg Co, Mount Gilead, Ohio.* Illustrated bulletin 5700 gives details on new, improved line of H-P-M cold chamber units from 200 to 800 tons. Construction features, specifications, standard and optional equipment covered.

6 THREAD ROLLING ATTACHMENT—*Landis Machine Co, Waynesboro, Penna.* 14-page bulletin G-96-2 contains detailed information on the Lanroll attachment for precision rolling of taper pipe threads. New design principles discussed and illustrated; specifications given for five sizes available for various sizes and makes of automatic screw machines.

7 GEAR CHECKING EQUIPMENT—*National Broach & Machine Co, 5600 St Jean, Detroit 13, Mich.* 16-page bulletin C55-9 pictures and describes the universal gear checker with five standard interchangeable measuring heads which are optional; Red Ring lead comparator, used on table of the universal checker; Model SIG internal gear checker; and gear rolling fixtures.

8 HYDRAULIC PLATE SHEAR—*Pacific Industrial Manufacturing Co, 848 Forty-ninth Ave, Oakland 1, Calif.* 8-page catalog 305 contains illustrated description of line available in ratings of ⅜ to 1½-in. plate. Includes data on controls, construction, and dimensions chart.

TOOLS AND ACCESSORIES

9 WORK BLADES AND GUIDES—*Cincinnati Milling Machine Co, Cincinnati 9, Ohio.* 30-page catalog G-678 presents detailed data on blades and guides for Cincinnati centerless grinding and lapping machines. Information on blade material, angle, thickness, size, setting; engineering data and dimensions included.

10 AUTOMATIC DRILLING AND TAPPING UNITS—*Hypneumat Inc, 647 W Virginia St, Milwaukee 4, Wis.* Bulletin 42-1-54 gives illustrated information on air or hydraulic-powered units, electrically operated, with capacity for deep hole drilling up to 25 in. in depth. Variety of models covered with specifications and operational details.

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11 REINFORCED RESINOID PRODUCTS—*Bay State Abrasive Products Co, Westboro, Mass.* 17-page illustrated catalog contains description of raised hub disk wheels, abrasive cutoff wheels, and resinoid straight wheels. Index page specifies recommended wheel for different types of operations, materials to be cut, and machine on which it is to be used. Basic information, diameters and operating speeds covered.

12 MACHINE KNIVES AND EDGE TOOLS—*Alcon Production Tool Co, 579 Baird St, Akron 11, Ohio.* 32-page illustrated catalog contains engineering data and stock list, applications, regrind information. Sections discuss Rockwell hardness, and tool steel for max abrasive resistance.

13 SR-4 STRAIN GAGES, INSTRUMENTS, ACCESSORIES—*Baldwin-Lima-Hamilton Corp, Electronics & Instrumentation Div, Waltham, Mass.* 16-page booklet contains information on new products including line of flat grid, fine pitch, bakelite gages for use as replacements for small sizes of wrap-around gages. Includes detailed discussion of gages, methods, selection, price list.

14 DRILL STOP—*Scully-Jones & Co, 1901 S Rockwell St, Chicago 8, Ill.* 5-page bulletin 18-50 illustrates and describes unit with new micrometer depth adjustment for drilling and reaming applications. Construction details, specifications, price list included.

15 ROTARY CUTTERS, FILES, RASPS —*Arejas Vitkauskas, 309 Varick St, Jersey City 2, NJ.* 17-page illustrated catalog contains data on Morrisflex (English-made) line. Specifications, conversion tables, ordering information included.

HEAT TREATING AND WELDING

16 ARC WELDING MACHINES—*Air Reduction Sales Co, 150 E 42nd St, New York 17, NY.* 44-page catalog 1340 (form ADC 708C) pictures and describes selenium rectifier and dc motor generator arc welders, ac and dc engine driven arc welders, ac transformer arc welders. Specifications for each machine, from ampere ratings to outside dimensions, are included.

17 WELDING TORCH—*Arcair Co, 419 S Mt Pleasant St, Lancaster, Ohio.* 4-page folder describes Arcair process and use of torch for cutting, gouging, grooving, or beveling. Applications illustrated.

18 ULTRASONIC FLUXLESS BRAZING—*Aeroprojects Inc, 310 E Rosedale Ave, West Chester, Penna.* 4-page bulletin SBR-6A contains information on Sonobraze equipment for fluxless brazing and metal coating.

PLANT SERVICE EQUIPMENT

19 GUSHER COOLANT PUMPS—*Ruthman Machinery Co, Cincinnati 2, Ohio.* 66-page indexed catalog contains engineering drawings and data on motor-driven pumps including immersed, pipe-connected, flange-mounted external or internal discharge types; shaft and pulley-driven pumps; mounting brackets and tanks. Foreword section covers general description, design features; different models on a variety of machine tools illustrated.

20 STORAGE AND HANDLING SYSTEM—*Stackbin Corp, 1139 Main St, Pawtucket, RI.* 20-page catalog 505 illustrates and describes Stackbin system for parts, tools, and materials. Dimensions, prices, installation photographs included.

21 AUTOMATIC CONVEYOR LUBRICATORS—*J N Fauver Co, 49 W Hancock, Detroit 1, Mich.* 8-page catalog CL956 gives illustrated description of new models incorporating improved design features.

22 4-WHEEL MAGNESIUM TRUCKS —*Magline Inc, Pinconning, Mich.* Series of ten new product bulletins give detailed descriptions and specifications data on line including platform, trailer, box, and towveyor trucks.

PARTS AND MATERIALS

23 STEEL DATA—*Joseph T Ryerson & Son, Box 8000-A, Chicago 80, Ill.* Revised edition of 256-page Steel Data book covers machining and fabricating, specifications and tolerances, weights and dimensions, elements and safe loads. Tables, definitions, general information included.

24 ALLOY PARTS—*Haynes Stellite Co, 30-20 Thomson Ave, Long Island City 1, NY.* Illustrated booklet on machinery parts made of Haynes alloys includes data on chemical compositions, physical and mechanical properties, corrosion resistance, machining. Separate sections cover cobalt-base, nickel-base, and iron-base alloys with typical applications for each.

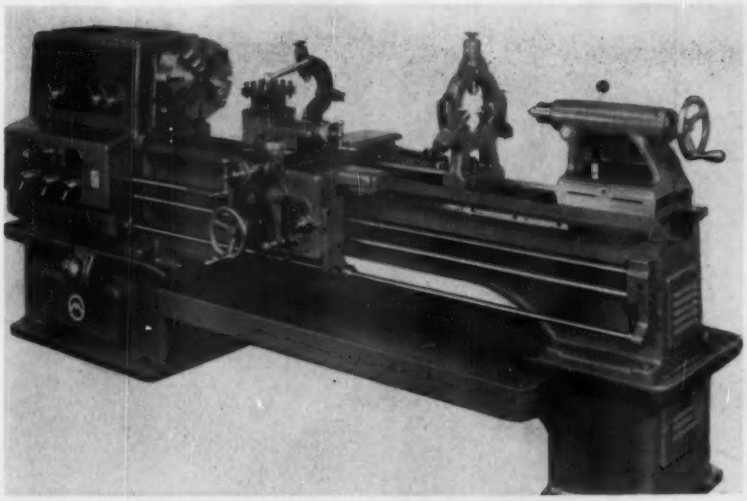
25 PRECISION INSTRUMENT COMPONENTS—*PIC Design Corp, Division of Benrus Watch Co, 477 Atlantic Ave, East Rockaway, LI, NY.* 128-page catalog 11 contains engineering data on variety of parts including gears with PD's of about 3 in., and small couplings.

26 VARIABLE PITCH DRIVES — *Browning Manufacturing Co, Maysville, Ky.* 11-page catalog V-183-A illustrates and describes new line. Complete specifications, engineering information, tables of practical stock drive combinations included.

27 FASTENERS—*Allmetal Screw Products Co, 821 Stewart Ave, Garden City, LI, NY.* 12-page illustrated catalog covering stainless AN fasteners describes government specification aircraft bolts, slotted and Phillips machine screws, flat and round rivets, and washers. Stock sizes, dimensions included.

28 PUSHBUTTONS — *Furnas Electric Co, 1044 W McKee St, Batavia, Ill.* 32-page catalog 5606A has illustrated descriptions of oil tight and general purpose pushbuttons, pilot lights, and accessories. Covers components and complete units, dimensions, cam action, schematic diagrams.

29 AIRCRAFT SWITCHES — *Micro Switch, Division of Minneapolis-Honeywell Regulator Co, Freeport, Ill.* 32-page illustrated catalog 78 covers complete line of phenolic encased units, high-temp switches, and small, metal-covered, hermetically sealed models. Electrical data, operating characteristics of 140 different switches, auxiliary switch actuators, and terminal enclosures.



Belgian Toolroom Lathes Come In Twelve Different Sizes

Line of Belgian-made toolroom and production lathes called Mondiale comes in 12 different sizes, ranging from 12 x 20 in. up to 20 x 100 in. Illustration shows the 20 x 60-in. model, which has 18 spindle speeds and 56 longitudinal and cross feeds. Speeds to 3000 rpm are selected by a gear-box control lever located within easy reach of operator.

To insure high surface finish, the final high-speed spindle drive is actuated by a direct V-belt transmission through the gear box to the spindle, bypassing the gears. Headstock spindle, equipped with double-opposed Timken roller bearings, is made of special heat-treated alloy steel, with drive at front end of spindle to eliminate any danger of torsion.

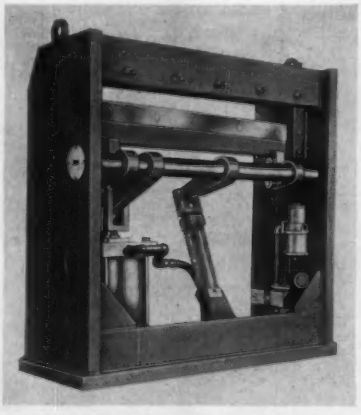
Double-wall design of apron reportedly makes machine more compact and lighter than similar lathes. Longitudinal and cross feeds are operated by a single lever, and automatic built-in safety devices prevent simultaneous engagements of any two elements. Feedshaft has a tripping device that interrupts longitudinal and cross motions within microscopic limits and protects unit against overloading.

Lathes are available in swings from 12 to 20 in., in all lengths, and with or without gap beds.

Imported by S & S Machinery Co, 140 53rd St, Brooklyn, NY

Air-motor inclining device intended for presswork requiring frequent die changes is available as optional equipment on Niagara OBI presses, Series E, A, and AA (45- to 200-ton models). Air motor drives the inclining nut through a high-ratio worm gear to move press frame up or down. With shop air pressure of 80 or 85 psi, press can be moved over full range in about 2 min. Device is self-locking to prevent press from dropping because of air failure or line breakage. Supplement 56-57-58.

Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY

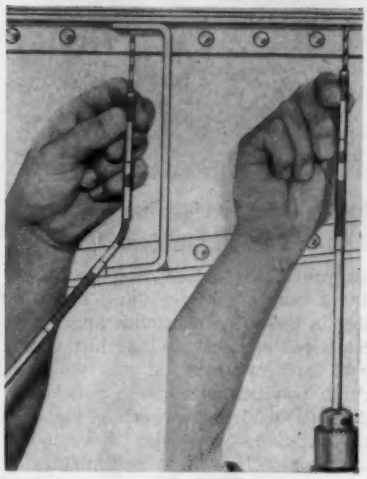


Air-Operated Shears Designed to Cut Strip

Shears are available for cutting strip up to 3/16 in. thick in mild steel, widths from 24 to 84 in. They are recommended for cutting hot or cold carbon or stainless, copper, aluminum, and other metals.

Controls are furnished to suit customer requirements. Unit is equipped with air filter, air lubricator, muffler, self-contained hydraulic shock cylinder, and setscrew adjustment for bottom knife.

Curry Air Shear Corp, 941 Oliver Bldg, Pittsburgh 22, Penna



Little Beaver Drill Extension Provides Flexible or Rigid Tool

Series 600 converts flexible drill extension to rigid one at finger flick, without shutting off power. Changeover is accomplished by sliding the locking sleeve to either position.

Device, which adds 10 or more inches to standard length drills, assembles in seconds. It can accommodate 52 regular drill sizes with corresponding chucks available in numerical sizes from No. 52 to 10, and in fractional sizes from 1/16 to 3/16 in. by 64ths. Details in bulletin 600.

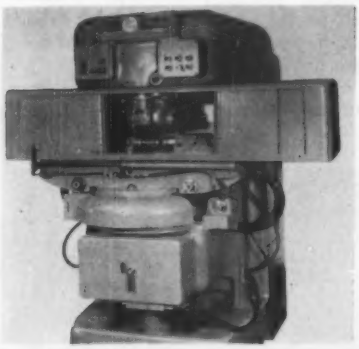
Beaver Tool Co, Box 256, Huntington Station, LI, NY

Welding electrode, designated Strike-easy 610, is reported to be first in E6010 class with iron powder coating. Iron powder eliminates slag interference, gives a more stable arc and improved shielding. Recommended for field construction, tanks, pressure vessels and machinery parts.

General Electric Co, Schenectady 5, NY

Optical tester, Watts Microptic Auto-Collimator, has been improved by a new micrometer drum that permits direct reading to 0.1 sec of arc. Optical and electrical systems have also been improved.

Distributed by Engis Equipment Co, 431 S Dearborn St, Chicago 5, Ill



Rotary Gear Shavers Incorporate Built-in Pushbutton Controls

Improved line of Red Ring machines has a new column design. Tunnels cast in the column provide space for electrical controls and permit compact flush mounting of the two machine pushbutton control panels in the top, within easy reach of the operator. Separate cutter drive gear box is also located in column's top.

Model GCU-8 in. is equipped for semi-automatic loading and shaves a helical transmission gear. Unit will shave spur or helical gears up to 4 DP having PDs from 1 to 8 in. Model GCU-12, from 1 to 12 in. Both models are available in three different types: first is a universal machine that provides for conventional shaving of gears including crowned and tapered; second resembles the first except that it does not include crowning or taper shaving attachments; third provides only for basic diagonal shaving with the two-stroke cycle.

National Broach & Machine Co, 5600 St Jean, Detroit 13, Mich

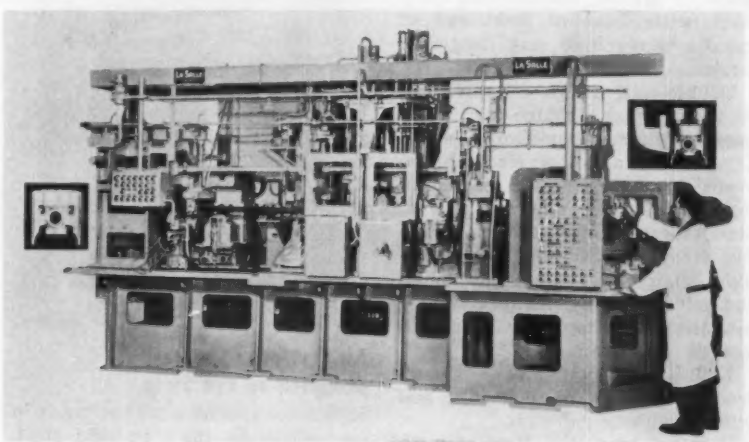
Cayuga Motor-Frame and Core Welder Handles 500 Parts Per Hour

Designed to handle No. 56 and 66 frames with a minimum of adjustment, motor-frame and core welder boosts electric-motor production by turning out 500 completed parts per hr. The 4-station machine utilizes company's Cayuga-Matic indexing table, with controlled acceleration and deceleration and precision locating.

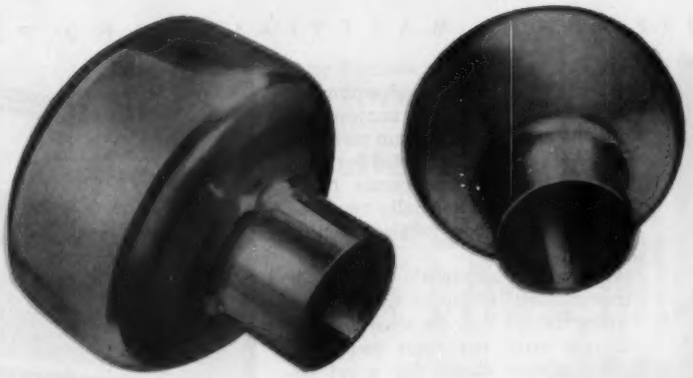
In operation, core is received on an expanding mandrel at loading station. Pushing a pushbutton brings wrapping and lining clamps into operation to wrap a pre-rolled frame around the core. Immediately upon completion of the frame clamping, the back-up comes up into position. Table now automatically indexes 90° to second station, where the weld is made and a hole is drilled through the frame bottom into the core. Another 90° indexing brings part to third station, where a chamfered pin is pressed into the frame and core hole, locking the two together. Table again indexes 90° to fourth station, where the work is ejected.

Cayuga Machine & Fabricating Co, Inc, W Gould & Long Sts, Depew, NY

PORTABLE ELECTRIC DRILL, Model 134, has 2.5 amp motor, ball-bearing spindle, and large, easily removed inspection plate. Drill has capacity of ½ in. in wood and ¼ in. in steel, speed of 1800 rpm, and weighs 3¼ lb. Price is $34.50—*Skil Corp, 5033 Elston Ave, Chicago 30, Ill*



AUTOMOTIVE PISTONS are produced on automated line at the rate of 400 per hr. Automatic unit combines 5 stations in a dial-type machine with 9 stations in an in-line machine. Any of 3 different pistons can be processed by changing selector switch and position of fixture locators. Operations include milling, piercing, facing, chamfering, gaging, weighing, and classifying by OD—*LaSalle Tool Inc, 3840 E Outer Dr, Detroit 34, Mich*



4 OF THE MANY STYLES OF THE ONE-PIECE SEAMLESS DOOR KNOBS FABRICATED FROM RUGGED REVERE BRASS STRIP.

REVERE BRASS STRIP

Stands the Gaff!

The one-piece door knobs shown are drawn from a single blank of Revere Brass Strip, presenting an attractively smooth, unbroken surface without the need for seams or welds.

Because they are made by a unique procedure the manufacturer tells us that the brass must stand up under mighty rugged going, and that to produce the quality knobs they do, at an economical production level, the brass they use must have:

1. *Uniformity of gauge.*
2. *Absence of any sign of fracture or crimping when drawn.*
3. *Consistently correct grain structure to insure a smooth, flaw-free surface on the finished knobs.*

The manufacturer also tells us that Revere Brass Strip has been filling that bill, with utmost satisfaction, for some time.

Revere Brass Strip may be able to help *you* make a better product at less cost. You'll never know until you talk it over with one of our TA's (Technical Advisor). There's no obligation, of course. And such a discussion could save you a substantial sum of money. Such has been the case many, many times.

COPPER * BRASS * 18 01 * REVERE * ALUMINUM *

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

Clearing Rotary Limit Switch Operates Auxiliary Equipment

Automation limit switch is a rotary cam unit designed for timing of material handling and other auxiliary functions necessary for automatic press operation. Extremely fine timing of such devices as iron hands, stock unloaders, die lifters, and dopers is possible with the switch; adjusments can be made through 30° of cycle.

Switch is placed within a dust-tight and oil-free compartment built into the press frame, where it operates from press driveshaft. Heavy-duty power take-off mechanisms are provided to assure accurate synchronization with press motion.

Switch is furnished in 3 sizes: four-cam, nine-cam, and eleven-cam. Proper switch is selected with a view to the number of automatic functions to be used in conjunction with the press. Eleven-cam switches are generally recommended for double- and triple-action presses. Nine-cam switches are normally required for straight - side single - action presses.

Control of automatic devices is accomplished in any of three ways: Timing relays can be used in conjunction with the limit switch to hold a circuit closed for a set period; with this method, one of the cams on the switch is used to energize a circuit and a timing relay will break the circuit when the set time has lapsed. In second method, two of the cams can be adjusted so that one cam will complete a circuit and another cam will break it. Thirdly, a single cam can be used to initiate the operation of a device where the device is stopped or returned by an external limit switch on the device itself.

Clearing Machine Corp, 6499 W 65th St, Chicago 38, Ill

Grey granite surface plates with 70.70 silica content are said to have extra hardness and natural relief areas which prevent sticking because of presence of high percentage of quartz. Special lapping as required in diabase for relief of ringing action is eliminated.

Herman Stone Co, Dayton, Ohio

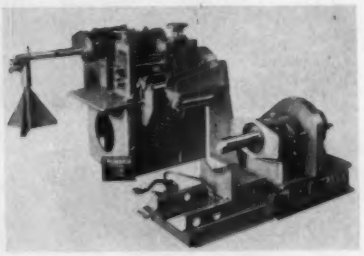
Electronic Gage Units Provide High-Speed Size Sensing

Gage team consists of a small electronic pickup cartridge, called Electrojet, for incorporating in new and existing gages and precision instruments, and a portable electronic amplifier, Accutron.

Transducer-type cartridge, ⅜ in. in dia by 1⅞ in. long, requires no pick-up calibration; this is accomplished by fixture setting only. Total stylus travel is approximately 0.110 in.; pre-travel, 0.005 in. It can be used with the full range of Accutron amplifications from 1000:1 up to 40,000:1. Amplifier has dual amplifications that can be switched from one to another without requiring realignment of the indicating meter mechanism.

Sheffield Corp, Dayton 1, Ohio

AIR-CONDITIONER COMPRESSOR CRANKCASES are machined on 8-station rotary indexing machine, which performs more than 20 operations, including rough-boring, counterboring, facing, spot-facing, drilling, chamfering, and tapping. Cycle is automatic, including clamping and unclamping—*Excello Corp, 1200 Oakman Blvd, Detroit 32, Mich*



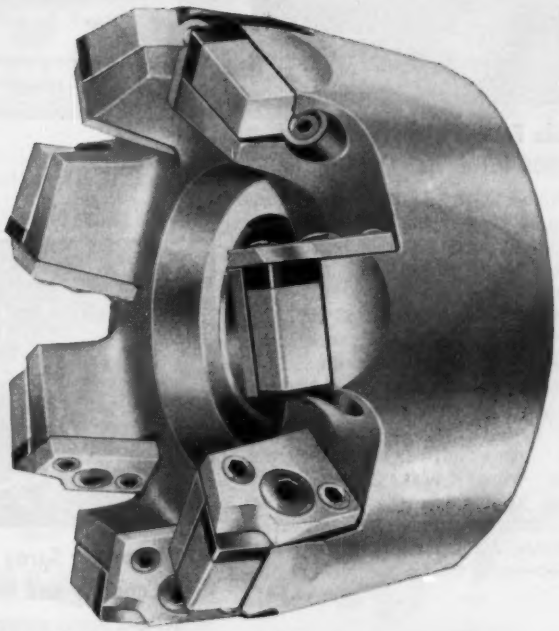
SLITTERS are designed to handle materials ranging from ultra-thin gages up to ¼ in. in ferrous and nonferrous metals. Machines produce close-tolerance widths by properly controlling the material at the cutting point with special stripping rings. "Pay-off" device adjusts during run of material to hold a uniform edge cut. Units operate at up to 1000 fpm —*H J Ruesch Machine Co, 407 Mulberry St, Newark 2, NJ*

You change only the throw-away insert

. . . not the cutter body

WITH NEW V-R ALL-PURPOSE FACE MILL CUTTERS

- **Save downtime . . .**
- **Reduce lost production . . .**
- **Eliminate carbide grinding . . .**
- **Reduce carbide costs**



You get eight cutting edges with each V-R square carbide insert. Replacement and indexing takes but seconds, thanks to V-R's exclusive design. The single main screw controls the elevator which clamps the insert against the chipbreaker plate. A recessed socket in each end of the main screw makes insert replacement fast and easy, regardless of the position of the cutter. There is nothing to fall out, nothing to fumble with.

All parts are replaceable and interchangeable.

Inserts are Inexpensive . . .
Lost Production is Costly

You do not remove the cutter body when cutting edges are worn in V-R's rugged new all-purpose Face Mill Cutter. Precision ground square V-R carbide throw-away inserts index perfectly just by slipping them in position and tightening the main screw. When using a negative rake cutter, you get eight cutting edges on every insert. When the inexpensive inserts are used up, throw them away and replace with new ones.

V-R Face Mill Cutters reduce downtime, *completely eliminate carbide grinding* and save money. They are available in 4", 6", 8" and 10" standard sizes. Other sizes available to meet your requirements.

Ask for new Bulletin for complete information.

Call your local V-R Representative or Distributor, or write:

MANUFACTURERS OF:
CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

Vascoloy-Ramet Corporation

SUBSIDIARY OF TANSTEEL METALLURGICAL CORPORATION

842 Market Street • Waukegan, Illinois

FM-567

Mobile Fork Lift Truck Lifts up To 1000 lbs at Heights to 60 in.

Equipped with dual lifting chains and a 12-v electrical system, Tubarlift Champion Stroller is designed to meet a wide variety of industrial applications.

Unit is 73½ in. high, 53 in. long, and 30½ in. wide, and can operate in a 6-ft aisle. Maximum lifting speed of the 25-in. forks is 33 fpm.

Other features include: welded steel body, roller bearing wheels, push button self-releasing controls, three wheel brakes, emergency brake, and a steering handle that locks back into place when released.

Uhrden, Inc, Tubarlift Div, P O Box 51, Dennison, Ohio

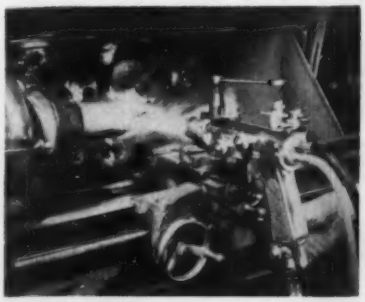
Rockford Tap Sharpener Handles 4, 5, and 6-Flute Taps

Designed to sharpen either left- or right-hand taps, Series 60 tap sharpener will sharpen 4, 5, and 6-flute taps. Series, which offers maximum collet capacity of 2¼ in., supplements company's Series 50 tools, which handle 2, 3, and 4-flute taps with a maximum collet capacity of 1-1/16 in. Additional flute capacities and collet sizes are available on special order.

Pushbuttons control radial relief and provide indexing for the amount of turn of the tap. Head is quickly adjusted by a knurled knob from 0 to 90° angle to the grinding wheel. Sharpener requires about 45 sec to set up or change taps, and does the sharpening in minutes. It can be used on any surface grinder with a magnetic chuck or can be bolted to the worktable.

Equipped with a 1½-in. collet, unit will accommodate any Hardinge 22-J collet to 2¼-in. capacity or equivalent.

Rockford Die & Tool Works, Inc, 1816 17th Ave, Rockford, Ill



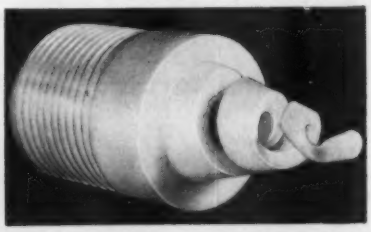
Metal Powder Spray Unit Has High Capacity and Efficiency

Model C-2 Spraywelder, designed for applying hard-facing powders to most types of steel (including stainless), cast iron and copper parts, features improved metal flow rates and higher deposit efficiency.

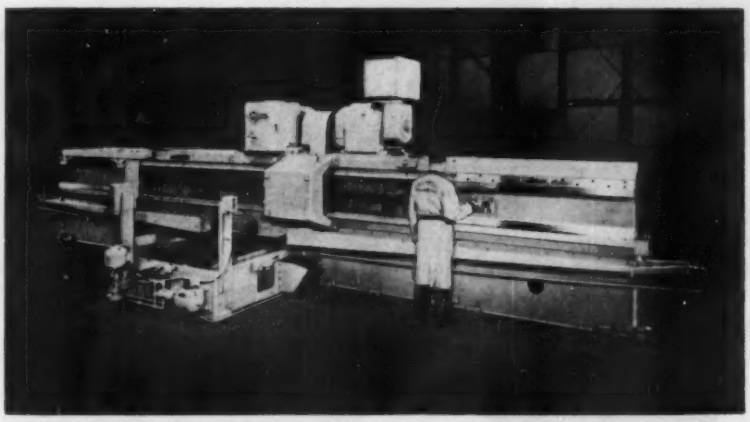
Powdered alloys are sprayed on, then fusion-bonded to the part by heating with oxy-acetylene flame. New unit can handle powdered form of aluminum, zinc, copper, nickel, stainless steel, brass, lead or brazing alloys.

Complete unit consists of lightweight aluminum pistol, hopper, carburetor, combination air regulator-filter, hoses and fittings.

Wall Colmonoy Corp, 19345 John R St, Detroit 3, Mich



SPIRAL-DESIGN TEFLON NOZZLES in TF series include orifices from ⅛- to 2-in. dia with flow rates from 2 to 70 gpm. In addition to company's previously announced hollow-cone models, it is now possible to obtain full-cone spray patterns, both-wide angle (120°) and narrow-angle (90°). Spiral design atomizes fluid without need for vanes or internal parts. Each nozzle is made from a single piece of teflon —*Bete Fog Nozzle, Inc, 309 Wells St, Greenfield, Mass*



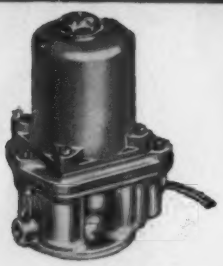
HORIZONTAL SURFACE BROACHING MACHINES with exceptionally long strokes are offered in several models: 240-in.-stroke units come in 15 and 25-ton capacities, with 18- or 24-in. ram-face width and with box or V-type ways. Similar models are also offered with 180-in. strokes. Most models are equipped with phenolic-lined ways. All models can be made avaiable with trunnion or horizontal shuttle tables. Broaching speeds range up to 300 fpm—*Colonial Broach & Machnie Co, Box 37, Harper Station, Detroit 13, Mich*

NEW Ross Starline

air control valve series

NEW long life

WHITE STAR
SPOOL SOLENOID



GOLD STAR
OIL-IMMERSED SOLENOID

BLUE STAR MV

BLUE STAR TD

BLUE STAR WV

NEW match any head to any valve body!

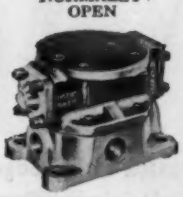
STRAIGHTWAY NORMALLY OPEN

STRAIGHTWAY NORMALLY CLOSED

3 WAY NORMALLY OPEN

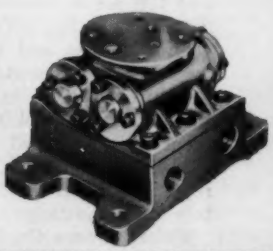
3 WAY NORMALLY CLOSED

3 WAY NORMALLY OPEN



3 WAY NORMALLY CLOSED

4 WAY



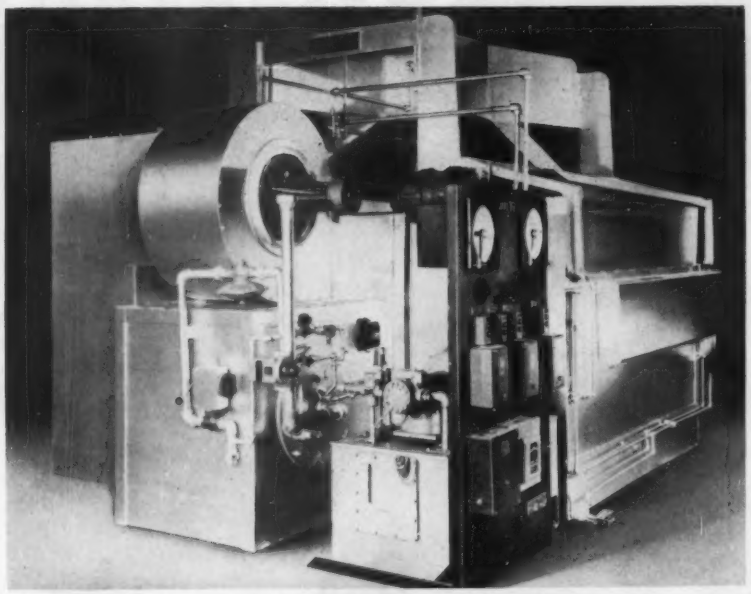
Tests indicate a trouble-free life of over 25 million cycles for valves with the spool solenoid pilot section, and *more than 40 million for all other Starline* valves shown.

Heads and bodies are completely and instantly interchangeable. Sizes from ¼" to 1¼". Even *more* Starline models coming later. Write for Starline data file.

A Galaxy of New Air-Control Stars Are Coming Your Way From

Ross OPERATING VALVE COMPANY

122 EAST GOLDEN GATE AVENUE • DETROIT 3, MICHIGAN



Waltz Furnace Flattens Sheets During Tempering Operations

Circulating-type furnace, which can be either gas or electric heated, is designed to flatten steel sheets or aircraft wing sections during tempering or precipitation-hardening operations. Sheets as large as 74 x 100 in. can be handled. A Vickers hydraulic unit at one side operates a hydraulic cylinder at the top of the furnace.

Inside the furnace are two cast-iron dies. Bottom die is stationary, and top die is mounted to the hydraulic cylinder with a ball joint. Doors at front and back allow the furnace to be used at both ends.

Controls can be in any combination desired. Control in the air stream is proportional, and in series with a controller in the die. These controls reportedly will hold temperatures to ± 5° in the range of 250 to 1100 F.

Waltz Furnace Co, Dept 'I, Symmes St, Cincinnati, Ohio

Fixture key made by Vlier can be secured in fixture base without drilling or tapping a screw hole. An integral part of key, lock consists of a cap screw, bevel nut, and expanding lock ring. After fixture key is inserted into reamed hole and proper flats are selected, cap screw is tightened. This action draws the beveled nut into the lock ring, expanding it against the wall of the reamed hole. Lock ring, made of music wire, locks key in the reamed hole.

Vlier Engineering, Inc, 8900 Santa Monica Blvd, Los Angeles 46, Calif

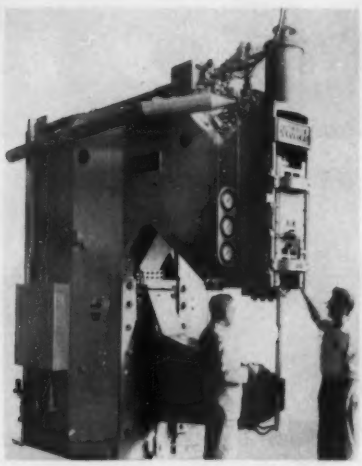
Johansson Sizing Gage Controls Grinding Operations

Pneumatic indicating gage called Deltameter is a Swedish-made device applicable to any grinder with a standard fitting for dial gages. It is suitable for machine control when gaging is done during the processing of parts, when selective sorting is desired, and when it is desirable to actuate electric circuits for control purposes.

Measuring heads with or without zero adjustment are available, as well as other measuring heads for different applications. Available with symmetric scales, gages are graduated in increments of 0.001, 0.0005, 0.0001, and 0.00005 in. Diameter of the dial is about 5 in., so that dial can be read from a distance. Instruments with up to 12 electric contacts can be furnished.

Scale range on each gage is 0.013 in., divided into one coarse and one fine measuring range. Measuring accuracy is reportedly ± 0.00005 in.

C E Johansson Gage Co, Dearborn, Mich

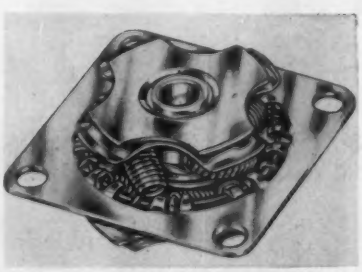


Federal Spot Welder Can Handle Large Aluminum Aircraft Structures

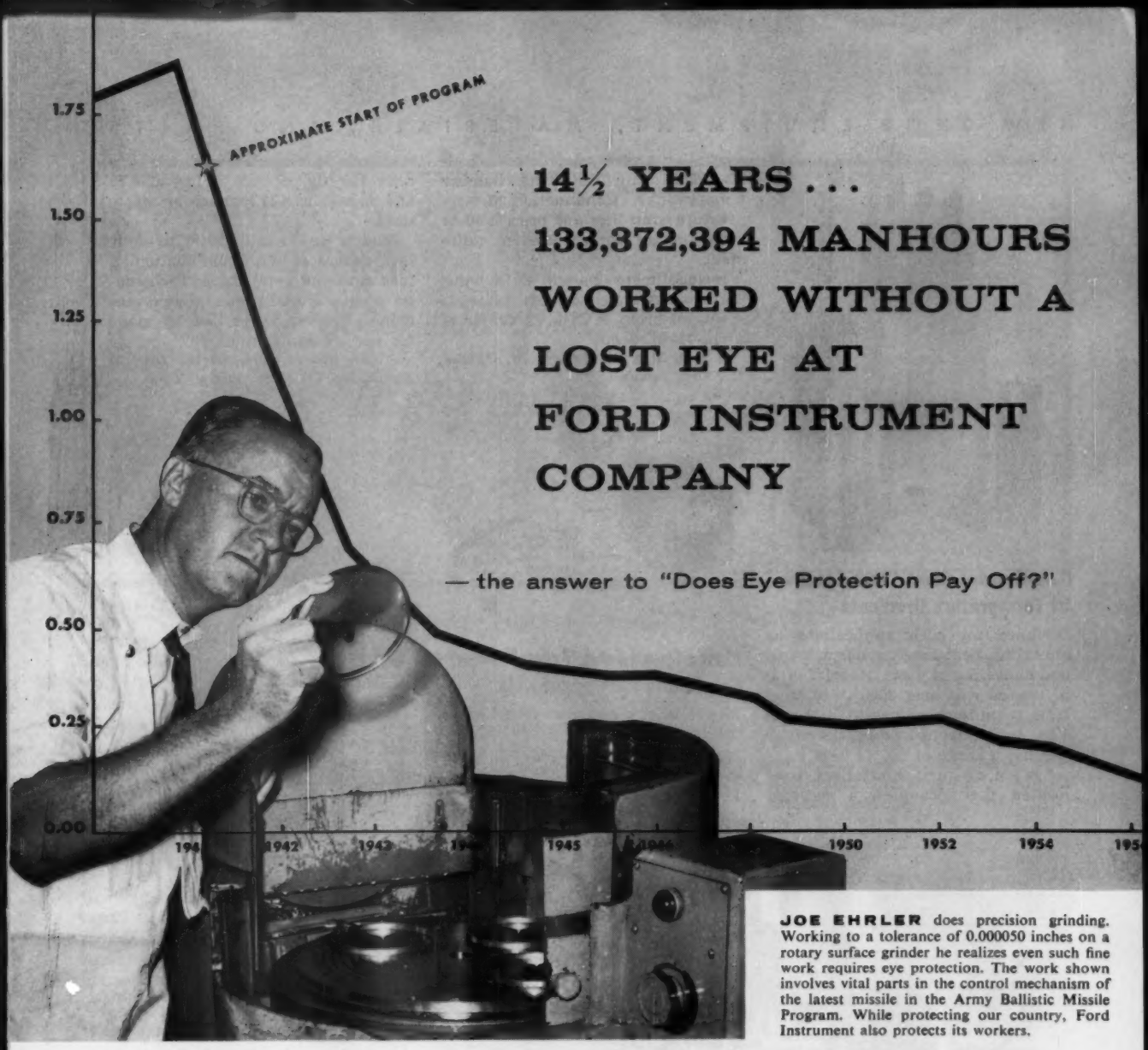
Designed with special throat area of about 2100 sq in., this three phase frequency converter spot welder is reportedly the largest of type ever built. Transformer supplying 100,000 amp welding current required new construction methods.

Welder is over 13½ ft high and weighs over 58,000 lb.

Federal Machine and Welder Co, Warren, Ohio



EQUIFLEX VIBRATION ISOLATOR and shock mounting, 125500 Series, is high-damped, diagonal-spring, all-metal unit said to withstand repeated 15g shocks without loss of efficiency, 30g ultimate. Currently available in No. 1 size plate type in ¼, ½, 1, 2, or 3-lb load rating—*Ucinite Co, Division of United-Carr Fastener Corp, Newtonville 60, Mass*



14½ YEARS . . . 133,372,394 MANHOURS WORKED WITHOUT A LOST EYE AT FORD INSTRUMENT COMPANY

— the answer to "Does Eye Protection Pay Off?"

JOE EHRLER does precision grinding. Working to a tolerance of 0.000050 inches on a rotary surface grinder he realizes even such fine work requires eye protection. The work shown involves vital parts in the control mechanism of the latest missile in the Army Ballistic Missile Program. While protecting our country, Ford Instrument also protects its workers.

Mr. Gilbert F. Tyler, Safety Director, states, "At 11:30 P.M., January 17, 1942 a milling machine operator was standing in front of his machine when the cutting tool broke and a large piece entered his eye. The eye was lost. Several months before, three other eye cases resulted in the loss of sight.

"An intensive eye protection program was started and has been continued to the present with ever increasing effectiveness and with the use of American Optical products.

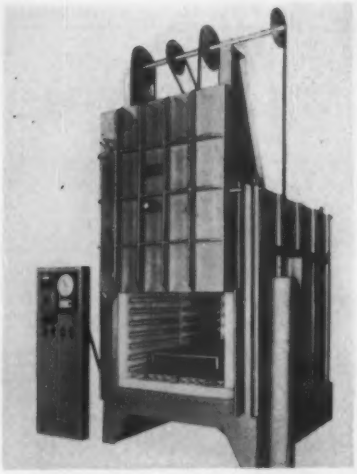
"During these 14½ years, Ford Instrument has experienced 133,372,394 manhours without a lost eye. During the last 5 years we have averaged one foreign body case per year of very minor nature. Under the voluntary educational system the operators are wearing eye protection equipment. In the last 10 months we have been practically accident-free of even the minor foreign body case."

The experience of Ford Instrument Company, Division of Sperry Rand Corporation, is typical. Cost of the injuries prior to the program was almost $2.00 per employee in compensation alone. Cost of the injuries currently is less than 3¢ per employee. Whether you are in metalworking, the chemical industry or wherever eye accidents can be costly, it will pay you to get the facts.

GILBERT F. TYLER, a leader in industrial safety, has been Safety Director for Ford Instrument Company, Division of Sperry Rand Corporation, since December 1952. His responsibility includes development and maintenance of an accident control program for the protection of personnel and plant facilities. He also acts as staff supervisor in safety problems, makes regular inspections and reviews methods, materials, machine guarding techniques and personal protective devices. He has contributed many articles on safety to national publications.

Always Insist on the Ⓐ Trademark on Lenses and Frames

American Optical COMPANY
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE • MASSACHUSETTS
BRANCHES IN PRINCIPAL CITIES



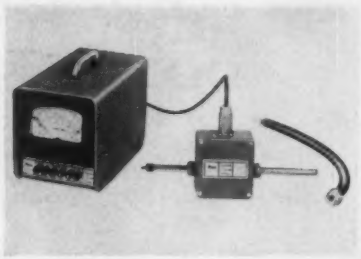
New Furnace Gives Close Control Of Temperature Gradients

Designed for such applications as annealing, heat treating, normalizing, and annealing of glass, Model V3672-S furnace will heat 2000 lb of steel from room temperature to 2000 F in 4 hr. Unit is front-loading, floor type and has a range of 300 to 2300 F.

System of input controllers, zone located thermocouples, a recorder controller, and a selector switch allows close control of firing chamber temperatures. Combination of temperature controller and precise 30-hr timer makes control system automatic.

Inside dimensions are: 40 in. wide, 36 in. high from hearth plate to spring of arch; 44½ in. to center of arch, 72 in. deep.

L & L Mfg Co. 136 8th St, Upland, Del Cty, Penna

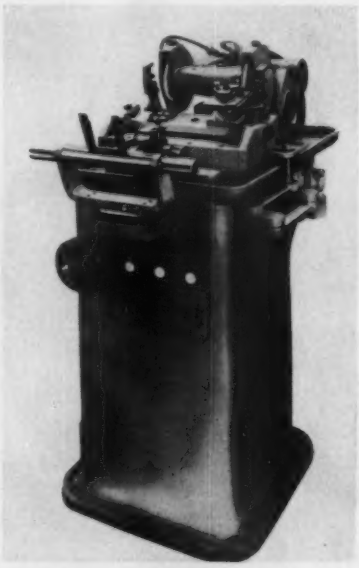


Maico Speed-Feed Meter Measures Travel and Rpm Accurately

Model MF-2 meter measures and indicates linear rates of travel and rpm on all types of machines where accurate feeds must be maintained. Feed rate pickup converts linear motion into an electrical signal that is read directly. Speeds as low as 0.25 and as high as 125 ipm can be measured.

Models are available with four feed ranges or with combination of feed rate and rpm scales. Tachometer pickup is easily mounted on machine. Special scales can be made for special applications.

Maico Co, Inc, Industrial Div, 21 North 3rd St, Minneapolis, Minn

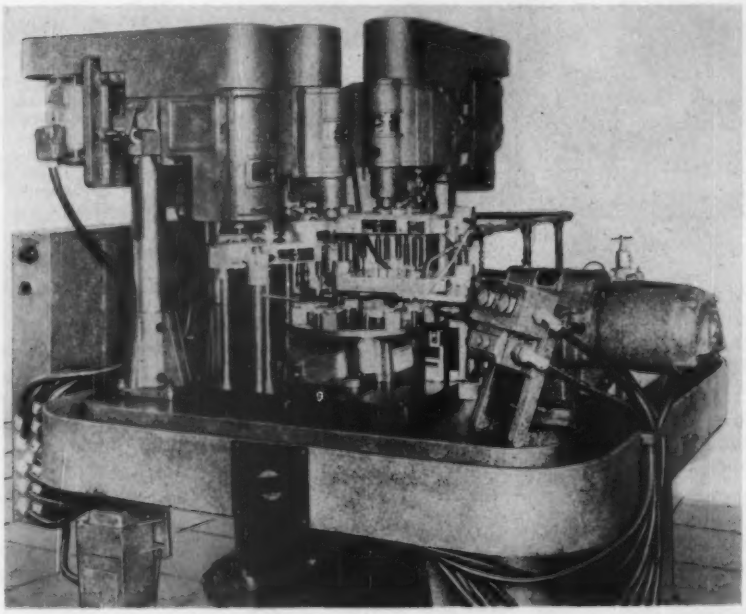


Copy Grinding Machine Incorporates Twin-Tool System

Copyrex permits simultaneous grinding of two identical cutting tools, profile gages, or production parts. An easily made templet, five times tool size, effects copying process through a parallelogram linkage to twin toolholders. Pair of diamond dressers keeps wheels trued.

Cylindrical grinding attachment to permit grinding of circular pieces up to 4 in. in dia is also available.

Carl Hirschmann Co, 30 Park Ave, Manhasset, NY



MAGNETO STATORS FOR GASOLINE MOTORS are machined on special 4-way drilling and tapping machine at the rate of 400 per hr. Every 9 sec, all at one time, 10 holes are drilled, 4 deburred, and 2 tapped in the aluminum-alloy workpiece. Machine consists basically of vertical drill units, 1 vertical leadscrew tapping unit, and 1 horizontal drill unit. Tooling consists of an 8-station No. 97 Ettco-Emrick index table with 8 nests to receive the part—*Ettco Tool & Machine Co, Inc, 594 Johnson Ave, Brooklyn 37, NY*

High frequency, vertical motor generators for induction heat treating applications are available in frequencies of 1000, 3000, and 10,000 c, with output ratings from 10 to 250 kw. Motor generators are totally enclosed and are air cooled. Rapid changes in power output and improved regulation are important features. No special flooring or foundation is required.

Weldaction Corp, 10230 Capital Ave, Oak Park 37, Mich

Undetected Machining Costs Can Lie Right on the Surface

Walking through your plant, it would be hard to see the needless costs hidden in undermachining or overmachining. These unnecessary costs can only be computed after parts are rejected by the inspection department and returned for further work . . . *or accepted with a costlier finish than required!*

Economy in surface finishing depends on machining to exact specifications. Whenever a surface is machined more or less than required, money is wasted. To avoid this requires accurate surface finish measurement *at the machine.*

Up to now, finish has been judged at the machine by looking or feeling.

The new Brush SURFINDICATOR provides a fast, accurate method for determining right at the machine the degree of surface finish produced.

This need not exist any longer, for a portable tool has been devised that makes accurate surface finish checking a simple matter, *anywhere in the plant.*

New Tool Eliminates Finishing Losses

The Brush SURFINDICATOR* is an easy-to-carry surface finish measuring device that can be used by any worker wherever needed—for in-process checking of surface smoothness. With this new tool, it is possible to meet optimum specifications without wasting material, time or money.

The operation is simple. A hand-held stylus is stroked over the surface that is to be measured. A direct reading is obtained in microinches, and the worker or inspector immediately knows the exact surface finish already produced. Not limited to one material, the SURFINDICATOR can be used on metals, glass, plastic, paper, wood and other surfaces for maximum finishing economy.

Both the new ASA Standards and the complete Brush SURFINDICATOR description are contained in this booklet. Send for your copy now.

Find out all about this new portable tool that produces savings by preventing finishing waste in your plant. The full story is told in the informative Surfindicator booklet. Also included are the new ASA Standards on surface finish for industrial use. Write for your copy today. *TM

BRUSH ELECTRONICS COMPANY

3505 Perkins Avenue, Cleveland 14, Ohio

BRUSH 6 ELECTRONICS

DIVISION OF CLEVITE CORPORATION

Hydraulic Tube Bending Press Handles Up to 1-in.-OD Tubing

Vertical ram-type unit can make two bends in each of two or more tubes and can bend two different angles in the same U frame.

Model 6-T, with self-contained hydraulic system built for continuous production, has a rated capacity of 6 tons. Full ram tonnage is available for bending action because center clamp moves with the ram and cushion pressure does not oppose ram tonnage. Press, which may be used for bending both steel or nonferrous tubing, handles up to 1-in.-OD steel tubing and can produce 1700 to 3000 bends per hour.

Pines Engineering Co, 601 Walnut St, Aurora, Ill

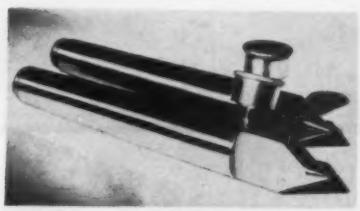
Redesigned Thor Drills Feature Less Weight, More Power

Universal electric drills in Silver Line EN Series are offered in sizes from ⅝ to 1 in., and supersede company's former UF Series. New tools are shorter, more compact, and more efficiently operated than older tools.

Model EN-5, with ⅝-in. drilling capacity, and Model EN-6, with ¾-in. capacity, come equipped with 3-jaw chuck and key. Two larger models, EN-7 (⅞-in.) and EN-8 (1-in.). have Morse taper sockets, which are also available as optional equipment for Models EN-5 and EN-6. All four models may be ordered with reversing switches in the handles.

Tools have as standard equipment 7 ft of conductor cable with plug, safety-switch handle, spade handle, and removable dead handle. Feed screws are available as extras. Speeds range from 430 rpm for smallest model to 300 rpm for the 1-in. drill.

Thor Power Tool Co, Aurora, Ill



Self-Lubricating Tailstock Center Reduces Metal-to-Metal Friction

Positive internal lubrication of Oil Jet centers prevents eccentricity caused by scored holes. Minute hole (jet) in point acts as reservoir while a small groove, at side of point, maintains a constant oil film. Centers are available in all sizes of Morse, B & S and Jarno tapers, and are precision made throughout. Shank is concentric with point within 0.0001 in.

Other features include: high wear resistance, high speed and heavy load capacity, cost about half that of live centers. Also available as half or gash-type centers.

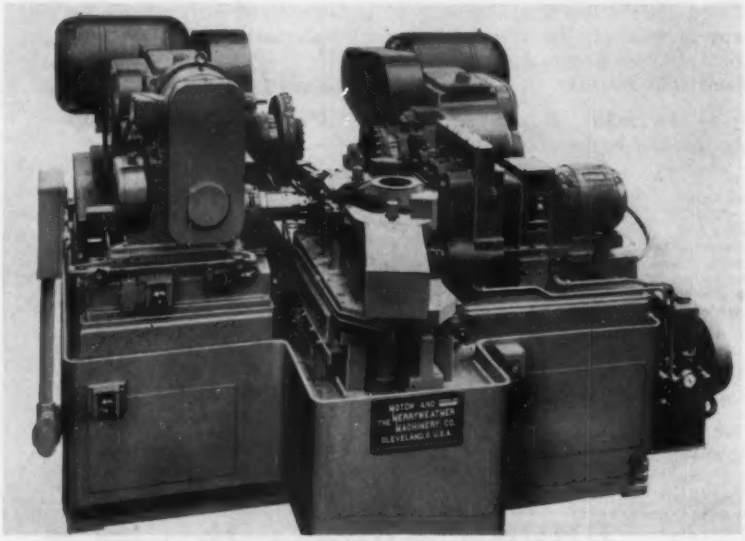
Tool Service Co, P O Box 10265 D, Tampa 9, Fla

Solid-carbide routers ground to close tolerances are offered for use on abrasive materials such as plastics, bakelite, die castings, copper, bronze, brass, and aluminum. Full range of standard sizes is available in all types, such as single straight flute, single righthand spiral, single lefthand spiral, and two- and three-flute spirals.

Atrax Co, Newington, Conn

Interchangeable jaw faces to fit Wilton machinists' vises are available in five different materials: steel, diamond serrated, hardened; steel, smooth, hardened; steel, smooth, soft; brass or copper, smooth; and plastic fiber, smooth. In addition, universal brass and copper jaw caps are available to fit over any of the steel or fiber jaw faces.

Wilton Tool Mfg Co, Inc, Schiller Park, Ill

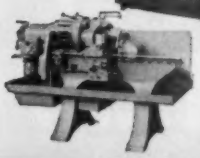


FARM-EQUIPMENT TRANSMISSION HOUSINGS are machined on special unit, which performs milling of two surfaces, drilling, rough-boring, and reaming on 27 parts per hr. In operation, table rapid-traverses to the rear and then feeds past two opposed milling heads. After milling, three holes are drilled in one side and the cored opening at the neck of the case is rough-bored on the opposite side. Table then advances to the final station, where 3 holes are reamed —*Motch & Merryweather Machinery Co, 888 E 70th St, Cleveland 3, Ohio*

GREENLEE

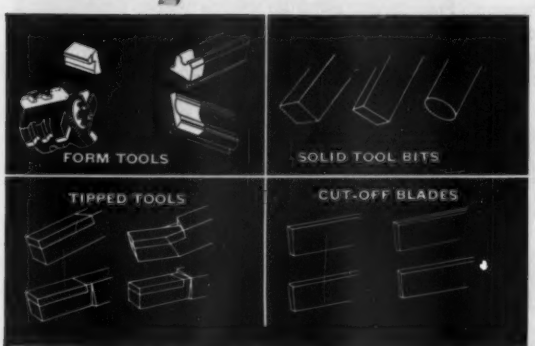
WARNER & SWASEY

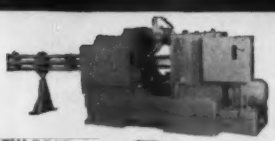
BROWN & SHARPE



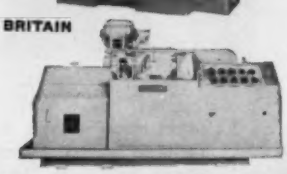
BARDONS & OLIVER

How to Reduce Costs by Tooling Automatics with V-R TANTUNG Cast Alloy

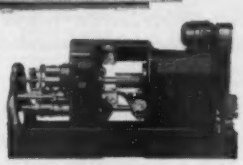




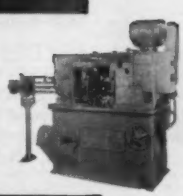
NEW BRITAIN



CLEVELAND



ACME-GRIDLEY



CONOMATIC

TANTUNG is a natural for single point and form tools for automatics, *particularly on short runs.* It is an exclusive chill cast alloy containing carbides of tungsten, tantalum and columbium—has high red hardness . . . low coefficient of friction . . . and high transverse rupture strength. It offers these cost-saving advantages:

1. ***Lower Grinding Cost.*** Tantung is easy to grind straight or to form. You do not need diamond wheels. Aluminum oxide wheels, such as used for hardened steel, are suitable. This feature effects major savings over carbide tools for short runs.

2. ***Lower Tool Cost.*** Tantung is available in solid tool bits, permitting many more regrinds than are possible with a brazed tip tool.

3. ***Higher Production.*** Tantung permits cutting speeds at least 50% higher—and up to 100% higher—than those possible with high speed steel.

4. ***More Efficient at Moderate Speeds.*** Tantung tools operate successfully at speeds too slow for efficient use of carbide and too high for HSS. They are ideal on multiple tooling setups where surface speeds of one or more operations fall below the carbide cutting range.

5. ***Available Cast-to-Form.*** By specifying preformed Tantung, you reduce grinding costs and secure longer tool life.

Whenever you are tooling automatics,
it pays to keep Tantung in mind.

SEND FOR FREE BOOKLET:

"Where and How to Use Tantung", a new booklet just off the press, gives complete information about Tantung—describes its characteristics . . . tells how to grind and braze it . . . explains the cost-saving advantages of specifying it cast-to-form . . . shows cutting speed ranges . . . describes multiple tooling setups . . . shows how it gets more work out of older machine tools that can't handle carbides. Send for your free copy, without obligation.

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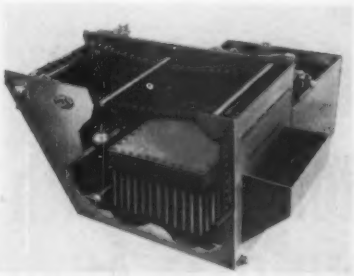
T-408

Vascoloy-Ramet Corporation

850 Market Street, Waukegan, Illinois



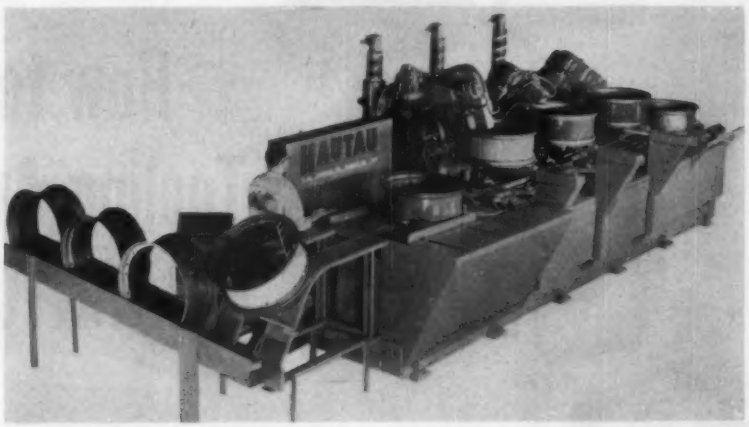
Tubular Screen Filter Is Efficient And Has High Flow Capacity

Designed for filtering coolants, cutting oils and all liquids containing minute particles, Delpark Filter-Matic requires little floor space and has a capacity of 5 to 1000 gpm.

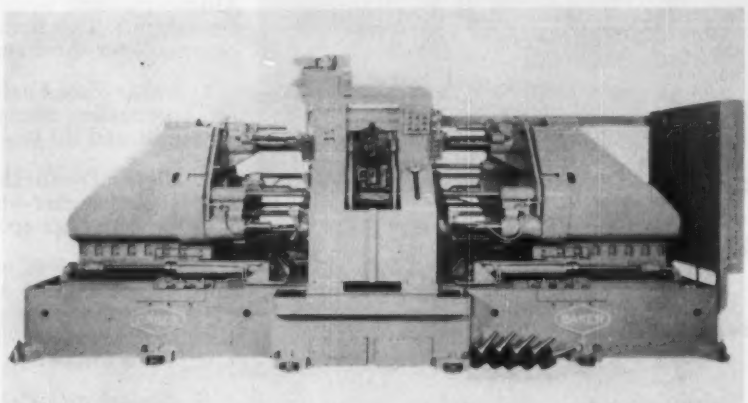
Small diameter screen tubes are manifolded into a common suction header through which sludge-laden liquid is drawn by multiple-chamber valve and pumped into a filtered liquid section. As screen deposits reduce liquid flow, unfiltered liquid level rises. This actuates, at a set level, a switch controlling the direction of flow through the valve. Reversed flow backwashes screens.

As reverse flow of clean liquid causes unfiltered liquid level to rise, float again reverses flow and filtering resumes. Sludge drops to bottom of filter compartment and is removed by dragout flights.

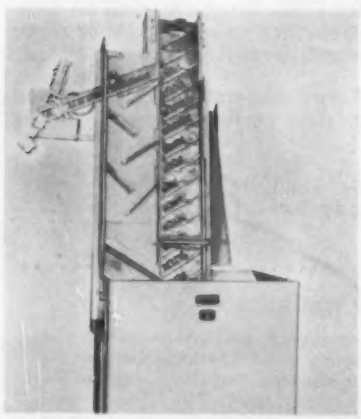
Industrial Filtration Co, Lebanon, Penna



LARGE WHEEL RIMS are automatically embossed, pierced, and chamfered on 5-station machine that combines 3 50-ton hydraulic C-frame presses and a high-speed in-line transfer mechanism. Presses are capable of rapid adjustment in three planes as well as rotary adjustment, so that die changes for different rims are greatly simplified. Approx 400 rims per hr are produced on unit, which measures 15 by 35 ft and is 7 ft high—*Hautau Engineering Co, 721 Wanda Ave, Ferndale 20, Mich*



FORGED STEERING KNUCKLES are machined on 5-station trunnion-type machine at the rate of 52 per hr. Special machine performs core drilling and reaming with a completely automatic cycle. Full-reduction heads with 15-hp bevel-gear drive are mounted on company's Model 1830 standard slides, and utilize standard tooling—*Baker Bros, Inc, Toledo 10, Ohio*



UNIVERSAL-JOINT SPIDERS are fed automatically to a special Landis centerless grinder by special feed (a modification of company's Model 2500). Parts are placed in the 9-cu-ft-capacity hopper, from which they are taken by elevating conveyor to the delivery chute for orientation and delivery to the grinder—*Feedall, Inc, Willoughby, Ohio*

BEAM BENCH SCALES are offered in three models with capacities of 52 105 and 300 lb. All models are portable; locking device permits use of beam as carrying handle—*Douglas Homs Co, 326 Jackson St, San Francisco 11, Calif*

Equi-Flex rod wiper/scraper is a 360° non-clogging metallic device for stripping foreign matter from reciprocating mechanisms. It is currently available in all popular sizes.

Equi-Flex Products Division, Master Pneumatic, Inc, 20430 Sherwood 34, Detroit, Mich

Worm gears, known as Crofts "Radiation" Worm Reducers, have recently been introduced. Units are fan cooled and are available in sizes from fractional to 450 hp.

Rockwood Pulley Mfg Co, Inc, 20 Crosby St, New York 13, NY

FIRST
with a COMPLETE LINE OF SAFETY SWITCHES to meet the NEW NEMA STANDARDS

TYPE HD TYPE ND TYPE LD

• The table below shows Square D switches meeting new industry specifications. Notice how they clarify conflicting features which existed under old designations. Notice, too, that they establish a new, heavy-duty industrial switch, Type HD.

One important thing which remains unchanged is the **DESIGN LEADERSHIP** which has made **SQUARE D SAFETY SWITCHES** industry's overwhelming **FIRST** choice for more than fifty years. Compare them, feature for feature. They cost no more, why settle for less?

DESCRIPTION	HEAVY DUTY New	NORMAL DUTY formerly Types H, S, or A	LIGHT DUTY formerly Types D or G
Rating-Ampere Voltage	30—600 250 or 600V AC, DC	30—1200 250 or 600V AC, DC	30—200 250V AC
Enclosure	NEMA 12 • Industrial Use (Gasketed) NEMA 4 & 5 • Water-tight & Dust-tight NEMA 7 • Explosion-resisting Class I—Group D NEMA 9 • Explosion-resisting	NEMA 1 • General Purpose NEMA 3R • Raintight	NEMA 1 • General Purpose NEMA 3R • Raintight
Horsepower Rating	NEC Fuse Ratings Dual-Element Fuse Ratings	NEC Fuse Rating Dual-Element Fuse Ratings	NEC Fuse Rating
Operating Mechanism	Quick-Make, Quick-Break Independent of Handle	Quick-Make, Quick-Break Independent of Handle	Positive Make, Positive Break Spring Assisted
Cover	Interlocked & Padlock Attachment	Interlocked & Padlock Attachment	Padlock Attachment
Plating—Current Parts	Extra-Heavy Silver	Silver	
Endurance	Maximum Endurance Far Exceeds UL Standards	Exceeds UL Standards	Meets UL Standards

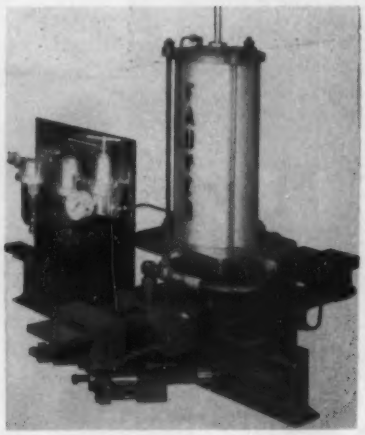
NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY

CUTTER GRINDER, Pear Model 3-ZN, is universal-type, Italian-made unit complete with built-in ¼-hp electric motor. Cutter can be used to grind tapered-shank cutters—*Imported by Aaron Machinery Co, Inc, 45 Crosby St, New York 12, NY*

Removable funnels which fit company's tumbling barrels are designed to speed loading as well as minimize spilling of materials. Made of heavy-gage steel, funnels can be quickly attached and detached. They are made for barrels with capacities from 1 gal to 8 cu ft. One side of the spout is vertical to permit use of two funnels side by side on multiple-unit barrel finishers.

Rampe Mfg Co, 14916 Woodworth Ave, Cleveland 10, Ohio



Improved Conveyor Lubricators

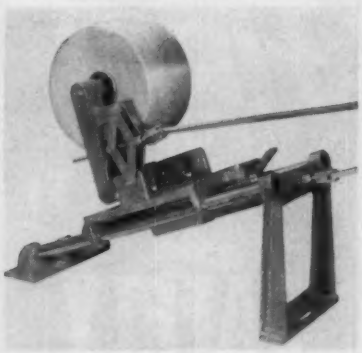
Series 700 has new air control panel, filter, regulator, and lubricator (Crown line by Hannifin); universal pick-up; and elimination of all drippage by use of a nozzle with automatic shut-off feature.

Model 702 lubricates one side of conveyor only; Model 704 lubricates both sides of a mono-rail conveyor.

J N Fauver Co, 51 W Hancock Ave, Detroit 1, Mich

Lift truck attachment, a magnet mounted between forks, insures fast, safe handling of metal plate. Magnetic device is controlled from truck cowl, and becomes energized as soon as load depresses switch in middle of magnetic plate.

Yale & Towne Mfg Co, Philadelphia 15, Penna

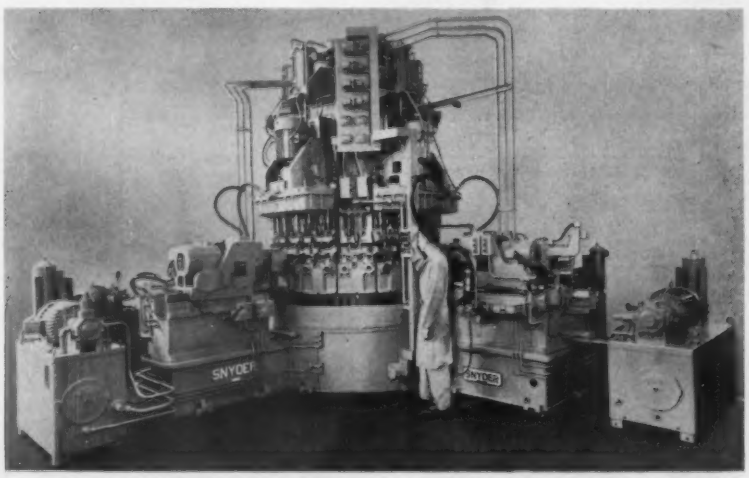


Backstand Idler Doubles As Belt Idler for Lathes

Fenlind L-610 designed as a belt idler for grinding and polishing lathes is adaptable to applications from precision work with narrow belts to heaviest roughing operations.

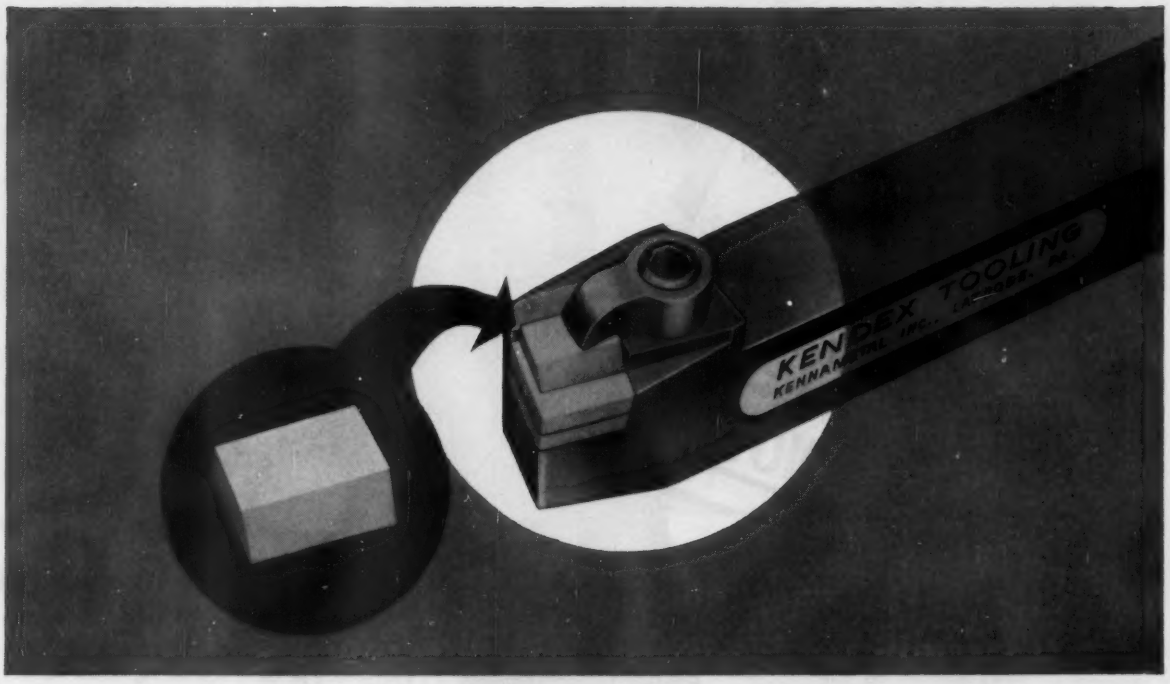
Linkages consisting of telescoping remote control arms and universal joints permit mounting of both tracking and tension arms at any position, above or on front of the polishing lathe. Control arms can be adjusted to accommodate belts of any length. Heavy-duty aluminum alloy pulley, radially crowned for perfect trackage and prevention of wear, is 10 in. in diameter and 6 in. wide.

Fenlind Engineering Co, 5602 Pike Rd, Loves Park, Ill



AUTOMOTIVE STEERING-GEAR BALL NUTS are drilled, reamed, countersunk, and chamfered on 16-station center-column machine at a rate of 311 per hr. Unit, which has a 96-in.-dia index table, occupies a 24 x 26-ft floor space and is 13 ft high over-all. Tooling consists of two 3-spindle, two 9-spindle, one 12-spindle, and one 18-spindle vertical heads. Parts are clamped hydraulically—*Snyder Tool & Engineering Co, 3400 E Lafayette, Detroit 7, Mich*

PRECISION WORM MILLING MACHINE, Model MS-15 from Germany, takes up to ⅞ DP worms and features electromagnetic multi-disk clutch, double-worm drive to milling cutter, and preselection of speeds and feeds. Six cutter speeds and four feeds are available. Small model, MS-12 (not illustrated), has range up to 2 DP, max-work dia of 10¼ in. and max length of 20½ in.—*Imported by Eric R Bachmann Co, Inc, 27-11 41st Ave, Long Island City 1, N Y*



You get uniform chip control with KENNAMETAL* Chipbreaker Plates

More pieces per shift... reduced tool cost... high precision machining

One of the important features of Kendex* Tooling is the uniform chip control that Kendex Chipbreaker Plates provide. Here are some of the advantages:

1. Chipbreaker Grinding Eliminated—costly grinding of chipbreakers ordinarily represents 60-70% of total regrinding costs where chipbreakers are required. Kendex Tooling eliminates all grinding, including that of chipbreakers.

2. Uniform Chip Control—provided over a wide range of feeds and speeds without any adjustments being required. This is vital to critical work. Ground-in chipbreakers tend to become too deep and too narrow after several regrinds. Each tool presents an individual problem that depends on the skill of the tool grinder and the condition of the grinding wheel.

3. Fewer Insert Failures—On jobs with heavy feed rates, Kendex Chipbreaker Plates greatly reduce pressures on the insert. The pressure required to curl chips is absorbed by the chipbreaker plate instead of the insert.

4. Easily Modified—Kendex Chipbreaker Plates are easily modified for unusual chip curling or breaking requirements. Furthermore, once the proper requirements are established, the plates remain constant. This eliminates the expense of continued, costly experimenting. If necessary, the chipbreaker plate can be removed and replaced without disassembling the Kendex tool holder and with no time lost in resetting the tool.

5. Complete line of Chipbreakers for Kendex tools available in two types: (a) for general purpose machining, and (b) for light feeds.

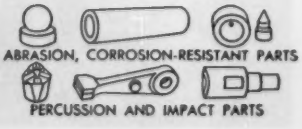
Your Kennametal tool engineer will gladly help you select the proper Kendex tool and Chipbreaker Plate for each job requirement. Call him or write to KENNAMETAL INC., Latrobe, Pa.

AVAILABLE NOW... A KENDEX CHIPBREAKER PLATE FOR EACH KENDEX TOOL

*Trademarks

C-5013

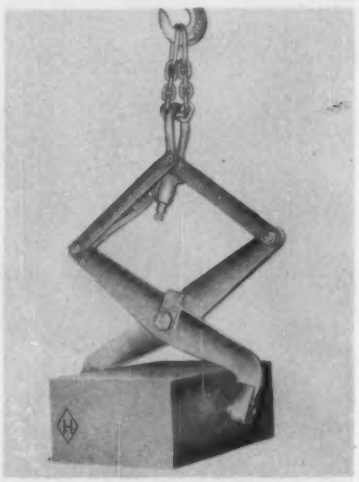
INDUSTRY AND **KENNAMETAL** ...Partners in Progress



Our new handy catalog gives you finger tip information on the type, model, H.P. and G.P.M. of the Gusher Pump that best fits your application. Write for it today—

THE **RUTHMAN** MACHINERY CO.
1818 Reading Road Cincinnati, Ohio

NOW!
new
economies in
NYLON GEARS
means savings in gear costs up to 90%
Our many years of pioneering and successful production of Nylon Gears, plus new reduced mold charges, can now make even greater economies for you in the use of Nylon Gears. With the great variety in molds now possible, Nylon should not only be considered as an economy measure but the answer to many problems where a compact design is necessary. Nylon Gears are quiet, durable, efficient and need less lubrication – they mate perfectly with metal gears.
Let our engineers with more than a decade in gear experience show you how Nylon Gears can save you money – let us consider your gear problems during the design process—send blueprints or specs for prompt estimates.
105
PROCESS GEAR CO., INC.
4614 W. Fullerton • Chicago 39 Illinois

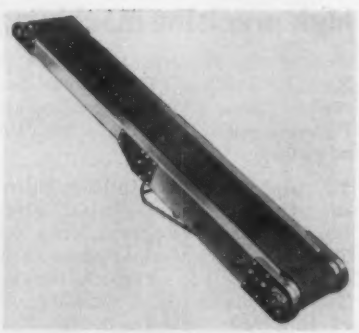


General Purpose Automatic Tongs Available in Two Sizes

In addition to lifting die blocks, tongs can be used for lifting other square, round, or rectangular objects up to their rated capacities.

One pair, designed for loads up to 3000 lb, has max jaw opening of 18½ in., max width of 27½ in., shipping weight of 50 lb. The other, for loads up to 5000 lb, has opening of 25 in., width of 37¾ in., shipping weight of 110 lb.

Heppenstall Co, New Brighton, Penna

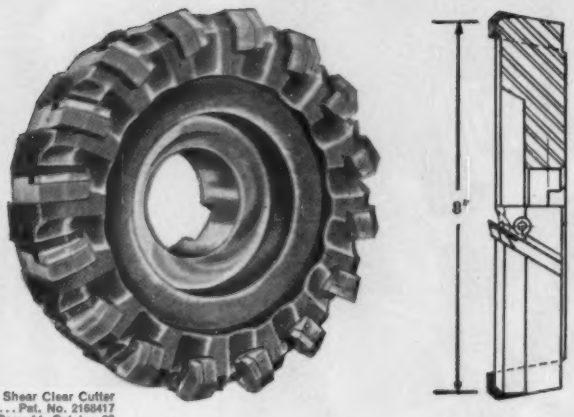


All-Purpose Conveyor

Features of light-weight unit, called Handy-Boy Model A, include bed made of heavy-gage, heat-treated aluminum, reversible movement of adjustable tension belt, full complement of wheel, stand and feeder attachments.

Hinged mounting brackets are available for attaching unit to wall of a staircase so that it can be tipped on its side when not in use. It is available in eight sizes ranging from 6 to 20 ft in length.

Hytrol Conveyor Co, Milwaukee 14, Wisc



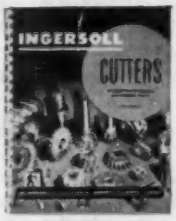
Ingersoll Shear Clear Cutter
27600 series . . . Pat. No. 2168417
Page 14, Catalog 66

Feed rate increased 2½ to 5 times at Vaughn with this INGERSOLL SHEAR CLEAR® CUTTER

The cutter previously used was nullifying the investment in a new standard, knee-type milling machine. The machine had more power than was being utilized. The feed rate was only 12″ per minute. The change to Ingersoll Shear Clear permitted the Vaughn Machine Company, Cuyahoga Falls, Ohio, to capitalize on its machine investment and obtain the economy and efficiency of increased feed rate. A feed range of 30″ to 60″ per minute, when milling rough forgings and steel castings, is now continuously maintained.

Ingersoll inserted blade cutters are used on all makes of machines for milling and boring a wide range of materials. An Ingersoll Cutter Division representative will be glad to discuss this and other feed rate experiences with you.

Whether you are concerned with feed rates, longer tool life, finish or cutter costs, the new Ingersoll cutter catalog will be a valuable guide. Write Department 66K.



Use this new 82 page guide for selecting the right inserted blade milling and boring cutters for your work. Write for catalog #66, today.

Representative Ingersoll Customers in Diversified Industries

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AMERICAN MACHINE & FOUNDRY CO.

AMERICAN MOTORS CORP.

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DE LAVAL STEAM TURBINE CO.

DOMINION ENGINEERING WORKS, LTD.

DOUGLAS AIRCRAFT CO., INC.

ELLIOT CO., INC.

FAIRBANKS-MORSE & CO.

A. FINKL & SONS CO.

GENERAL ELECTRIC CO.

INTERNATIONAL BUSINESS MACHINES CORPORATION

INTERNATIONAL HARVESTER CO.

KAISER ALUMINUM & CHEMICAL CORP.

NORTON COMPANY

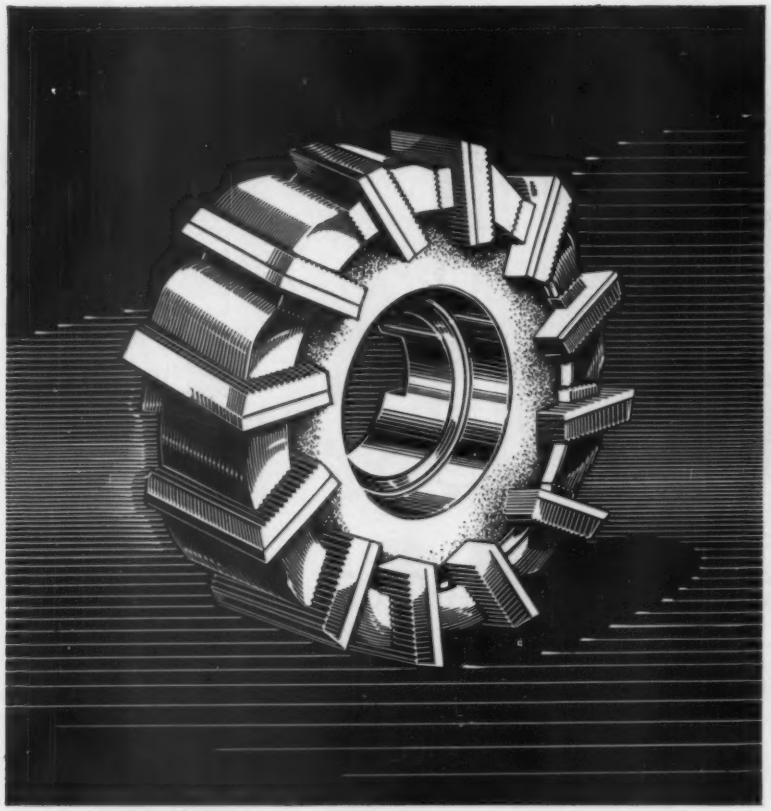
UNITED STATES STEEL CORP.

VAUXHALL

CUTTER DIVISION

THE INGERSOLL MILLING MACHINE COMPANY

ROCKFORD ILLINOIS



A VERSATILE MILLING CUTTER?

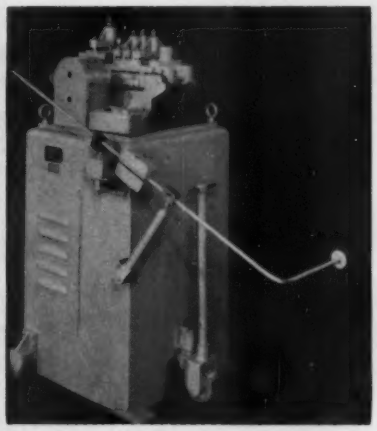
Sure, that's the best description you could apply to a Go & Go inserted high-speed steel blade milling cutter. Here's a tool that's equally at home banging out high production day after day or down in the toolroom carefully carving out a new die. And you can use it on almost any material.

When blades wear, and they do, it's a simple matter to set them out, resharpen and put the cutter back in production. After you've squeezed the last bit of tool life out of the blades, just order new ones from stock and insert them in the cutter body. Blade cost is so low most shops keep several sets on hand all the time.

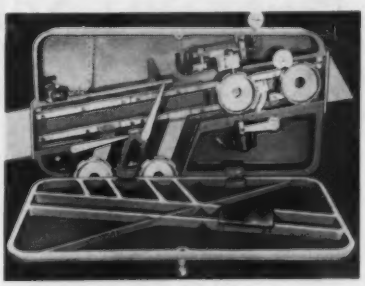
You can choose just about any style and size of inserted HSS blade milling cutter you'll ever need from the complete line of standards manufactured and stocked by Go & Go. For specifications, ask for Catalog "F". Go & Go also designs and manufactures special milling cutters in quantity. Check your nearest Go & Go representative for details.

Go & Go

GODDARD & GODDARD COMPANY
DETROIT 23, MICHIGAN
Engineering and producing tools that Go & Go since 1917.

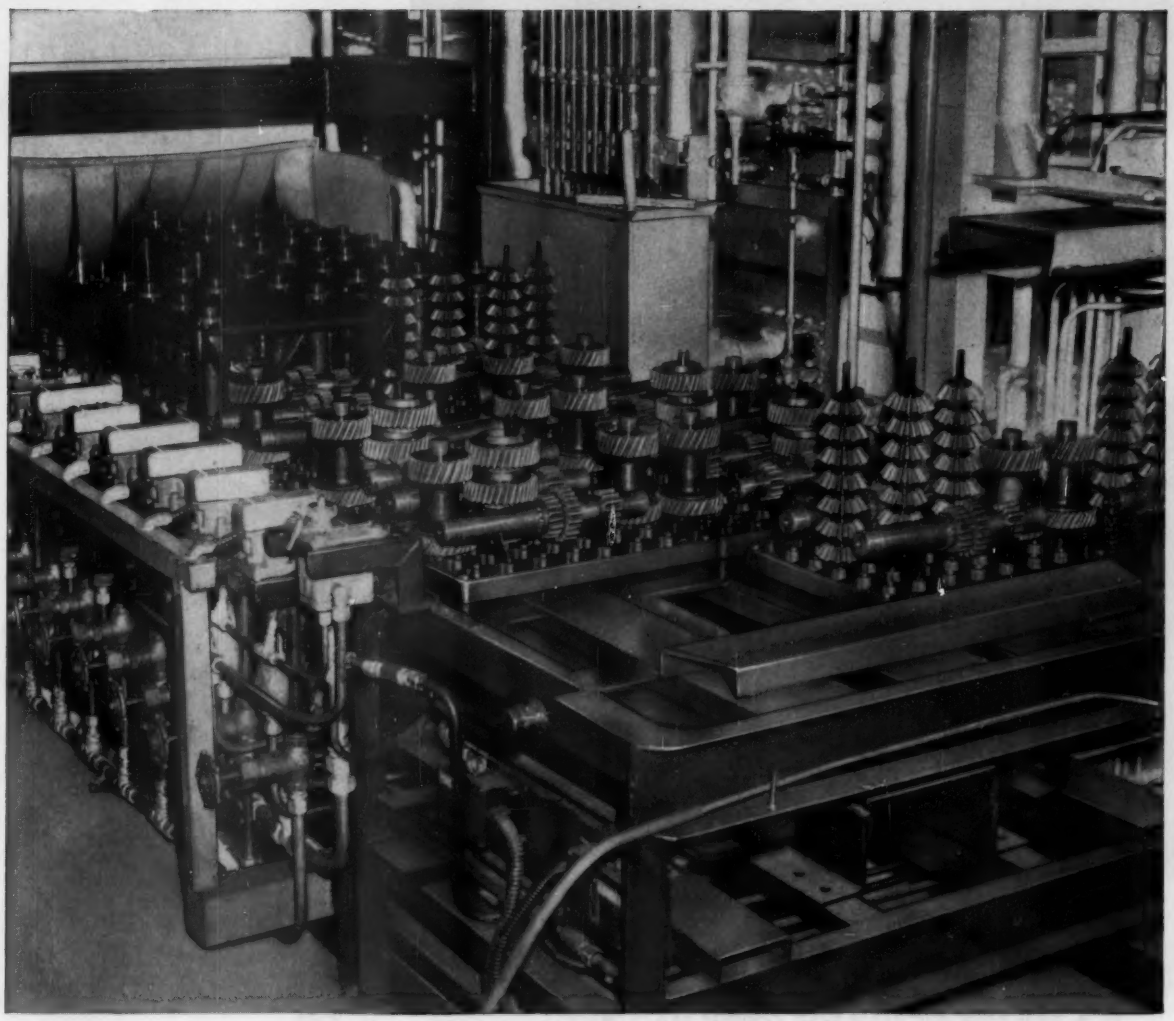


POWER - DRIVEN STRAIGHTENER, Model PDS 4½, handles material up to 4½ in. wide by ⅛ in. thick. Unit has a pair of power-driven take-in rolls and 6 straightening rolls (upper three individually adjustable and lower three power-driven). Straightener assembly is of hinged construction, so that it can be opened for easy threading of the end of a new coil. Variable-speed drive of ½ hp runs the unit—*U S Tool Co, Inc, Ampere (East Orange), NJ*



GEAR CLASSIFIER for checking root diameters of external splines or keyways on drum-type parts uses gaging action based on point contact of individual probes. Designed for integration into automated lines, unit gages automatically, uses root diameter as a reference base. In operation, parts move down an inclined ramp to a stop position, then are indexed and measured by upper and lower probes. Qualified parts then continue through unit to the next operation; rejected parts are shunted aside—*Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich*

Gage accessory, known as Booster-Bar, is now available for use with company's previously announced Center-Mike hole-location gages. Largest extension unit adds



Surface zoned gas carburizing toughens gears, cuts steel costs

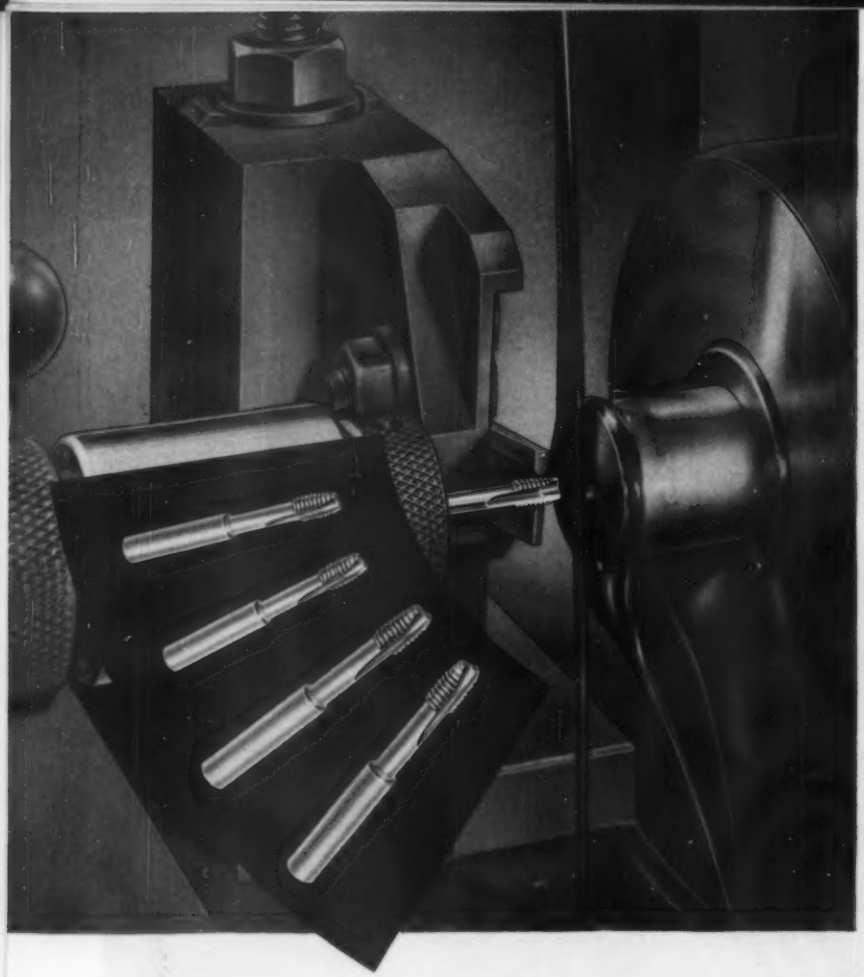
The manufacturer of these heavy duty truck gears improved metallurgical properties and reduced material and labor costs when he adopted Surface zoned gas carburizing. Unique atmosphere manifolding enables him to limit surface carbon content (80% max.), get sufficient case depth, and still maintain good carburizing rates (530-900 net lbs./hr.). With the quality of Surface carburizing, he could use steels lower in alloy content.

Cases like this explain why 1,500,000 cfh of atmosphere gas are generated daily in Surface generators. For quality carburizing at competitive costs, check with Surface.

SEND FOR BULLETIN SC-172 • SURFACE COMBUSTION CORPORATION • 2365 DORR ST., TOLEDO 1, OHIO

Surface® Heat Treat, Steel Mill, Glass Divisions • Kathabar® Air Conditioning Division
Janitrol® Heating and Air Conditioning Division • Janitrol® Aircraft-Automotive Division

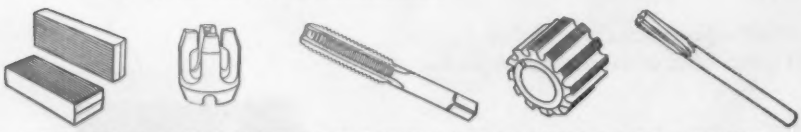
Surface®
HEAT TREATING EQUIPMENT



Here, for the FIRST Time . . .

IS A TAP SPECIFICALLY FOR SCREW MACHINES.

This new high speed steel, ground thread tap with its short thread length, spiral point, and specially heat-treated necked shank cuts cleaner threads, has longer life, reduces bellmouth condition and tap breakage . . . and pays big dividends in improved work quality, increased output, and lower tooling costs! Tests prove that performance is excellent on practically all machinable metals. Plug and bottoming types in machine screw sizes No. 2 to No. 10 . . . available *now* from stock at the P&W Branch Office near you. Write for complete information. *Pratt & Whitney Company, Inc., 11 Charter Oak Boulevard, West Hartford, Connecticut.*



. . . THREAD ROLLING DIES • DUOCONE DIES • TAPS • THREAD MILLING CUTTERS • REAMERS . . .

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

9 in. to measuring range. Each Booster-Bar unit has two precise-length rods held in plastic brackets that are slotted to hold Center-Mike.

Sorensen Center-Mikes, Inc, 264 Kossuth St, Bridgeport 8, Conn

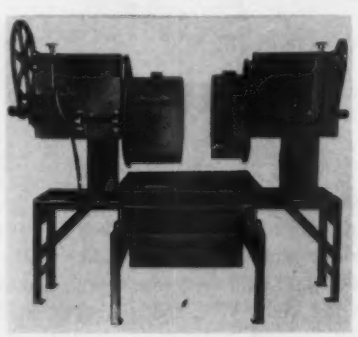
Skid and Pallet Lifts Handle 6000-lb Loads

American skid lifts and pallet lifts are offered in several models, with the largest of each type capable of carrying 6000-lb loads.

Skid lifts, offered with hydraulic lifting mechanism, are available in 18- or 24-in. widths, with steel, rubber, or plastic wheels. Platforms from 36 to 72 in. long are available.

Pallet lifts (not illustrated) are offered in 3 load capacities. Seven fork lengths between 30 and 60 in. are available. Models are 22 or 27 in. wide.

American Pulley Co, 4200 Wissahickon Ave, Philadelphia 29, Penna

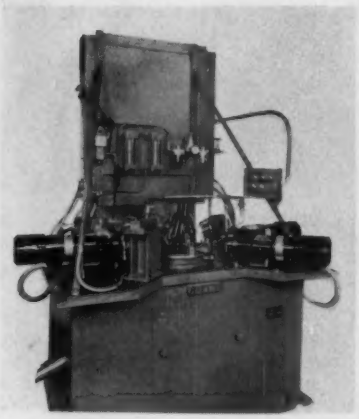


PIGGY BACK STAND with two legs to bolt to the frame of the Rampe screen separator supports tumbling unit in position to unload into the separator—*Rampe Manufacturing Co, 14915 Woodworth Ave, Cleveland 10, Ohio*

Removable fork extensions for use with company's line of low-lift pallet-type trucks slip onto the stand-

ard forks, doubling the length of the forks. Extensions enable pallet trucks to handle long, light loads on either skid platforms or open-face pallets.

Lewis-Shepard Products, Inc, Dept R-39, 125 Walnut St, Watertown, Mass



AUTOMOTIVE PARTS are machined on special unit which incorporates five Govro-Nelson automatic drilling units, together with a power saw. Unit drills, taps, taper reams, slots, and deburrs work, performing the 6 operations on 700 parts per hr. Operator merely clamps part in machine; all operations, as well as clamping and ejecting are automatic. Machine is readily adaptable to a variety of operations—*Govro-Nelson Co, 1931 Antoinette St, Detroit 8, Mich*

Tap inspection accessories, for use with company's Tap Analyser, consist of precision chuck of 0 to ½-in. capacity, and sets of lenses that allow inspection of larger taps by lowering the magnification to 30X, 24X and 18X.

Stocker & Yale, Inc, 40 Green St, Marblehead, Mass

Flareless tube fitting, Hi-Seal, makes butt-tight joint and is designed for full range of pressure conditions. There is no need for tubing to be sprung, and no flaring or threading of tubing is necessary. Available in steel or stainless steel, it comes in sizes for ⅛ to 1½-in. OD tubing, and can be furnished with Dryseal pipe threads or with straight threads with O-Ring seal.

Imperial Brass Mfg Co, Dept HSF, 1200 Harrison St, Chicago 7, Ill

210,000 HOLES . . .

AND STILL RUNNING!

120,000 pieces before the first grind . . . 90,000 after grinding . . . and still producing accurately threaded holes! These are the actual performance figures reported by a satisfied user of P&W Taps. Performance like this is possible, because P&W Taps are *always* accurate, always concentric with shanks, threads, OD's and chamfers . . . *all* ground *on centers.*

When you buy taps, *you're really buying the number of finished workpieces they'll produce.* That's why Pratt & Whitney Taps and other Cutting Tools are your best buy. Complete lines available from stock at the P&W Branch Office near you. Write for full information. *Pratt & Whitney Company, Inc., 11 Charter Oak Boulevard, West Hartford, Connecticut.*

. . . MILLING CUTTERS • CUT-OFF BLADES • END MILLS • KELLER CUTTERS • KELLERFLEX BURS . . .

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

another BAKER bonus

TWIN PULL

. . . SERVICE IS A SNAP

Many reasons for Baker's twin pull hydraulic feed cylinders. They're out in the open . . . easily accessible for maintenance. Are more compact (3¼" diameter). Have adjustable chevron packing. And they're exclusive with Baker. Twin pull can be had on Baker specials — or on Baker Basics, for automation with *standard* machines.

BAKER
AUTOMATION
Best in the long run
Practical in the short run

CHECK AND MAIL FOR DATA

( ) Twin pull hydraulic cylinders
( ) Flame-hardened, ground steel or cast iron ways — durable
( ) Separate Porta-Pak power feed unit — accessible for maintenance
( ) Big ball bearings throughout, rugged construction

BAKER BROTHERS, INC.
Dept. AM-257, Toledo 10, Ohio

Yes, tell me more about these Baker Bonuses . . .

NAME AND TITLE

COMPANY

ADDRESS

CITY ZONE STATE

DRILL CHUCK, called Mini-Chuck, has cut-back slot which permits full tension grip of the drill to prevent slippage and pull-outs. Available in range of chuck sizes from No. 50 to "F" with adapters to fit spindles of standard angle head and snake drills—*Beaver Tool Co, Box 256, Huntington, LI, NY*

Dust collectors, Series 80, have been redesigned to increase storage capacity 2½ times. Containing 150 sq ft of cloth filtering area, the filters can handle from 580 to 1100 cfm at speeds of 5000 to 8000 fpm. Prices range from $398 to $448.

Torit Mfg Co, Dept KP, 287 Walnut St, St Paul 2, Minn

Brightening powder reportedly gives mirror-bright, iridescent-free surface on zinc plate with one dip. Kenvert #16 operates in temperature range from 90 to 110 F and requires no ventilation. Process offers corrosion protection and resistance to staining and fingerprints.

Conversion Chemical Corporation, Rockville, Conn

Anocut Power Supply Units Boost Electrolytic Grinding Production

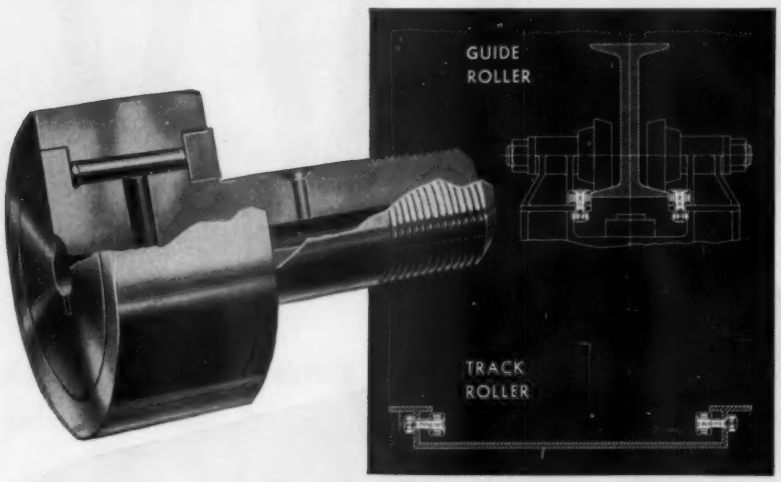
Power supply units of 1000- and 3000-amp size have been developed to provide production rates in the electrolytic grinding and milling of parts. Units, which supplement company's previously announced 300-amp unit, permit use of larger grinding wheels, with more rapid stock-removal rates.

Power units can reportedly be attached to most grinding machines with only a few basic modifications. Bulletin 300.

Anocut Engineering Co, 531 W Washington Blvd, Chicago 6, Ill

BEARING TIPS by McGill

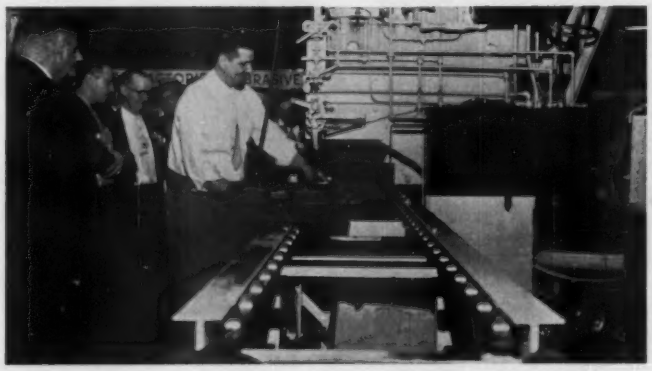
Let a CAMROL bearing be your guide



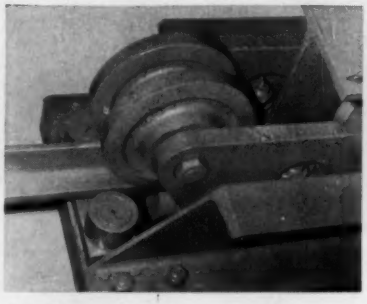
Obtain freer rolling, improved alignment and positive side thrust

In guide and support roller applications CAMROL Cam Followers insure free rolling action and positive side thrust while eliminating the wear of more costly flanged wheels. Then, too, they provide improved alignment and low starting and running friction with high unit load and shock capacity, especially at low speeds as track rollers. Lubrication is simplified and maintenance can be reduced to a minimum in these applications. Specify the interchangeable sealed SGR series for added protection against contamination.

CAMROL CF bearings provide friction-free track rollers for automatic mold blower



McGill CAMROL CF rollers are used as guide rollers to form a mold conveyor in the Beardsley & Piper MBS-20 Mold Blower. The machine blows and squeezes cope or drag in a single automatic operation, handling up to 4 molds per minute. The CAMROL CF bearings replaced less efficient friction rollers in this application. Although, the duty here is rather light and speeds slow, the cam follower bearing provides lesser starting and running friction. This helps speed the flow of work from the machine, which must be fast and automatic. The integral stud feature eases assembly and its standard design simplifies procurement.



CF bearings minimize maintenance as crane side guide rollers

McGill CF cam follower bearings serve as side guide rollers in overhead cranes manufactured by Louden Machinery Company of Fairfield, Iowa. Freedom from maintenance, a time saver because of the inaccessibility of the bearing when the crane is in operation, is an important advantage of the cam follower bearing.

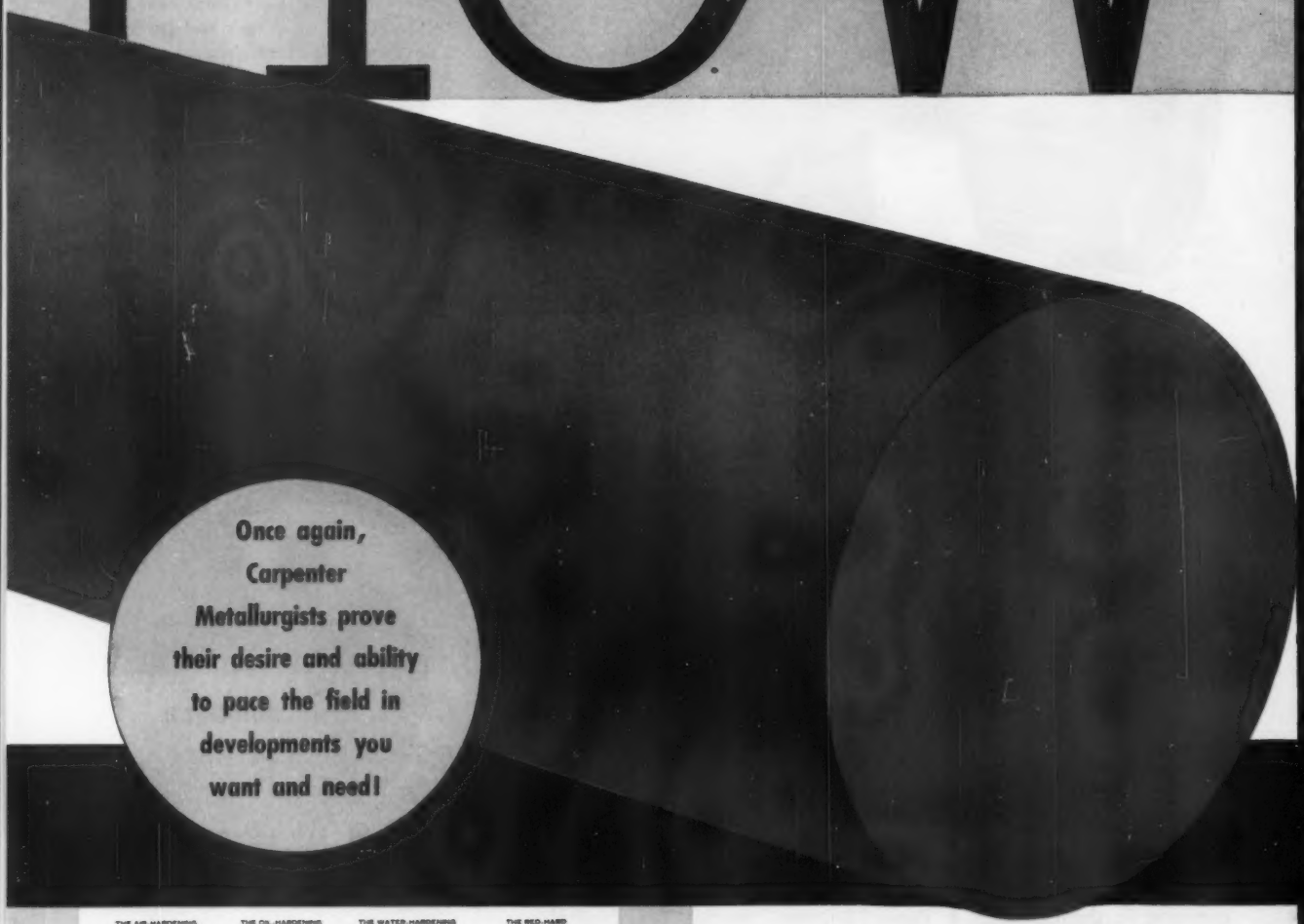
Send for Catalog No. 52-A

Insure performance with McGILL®

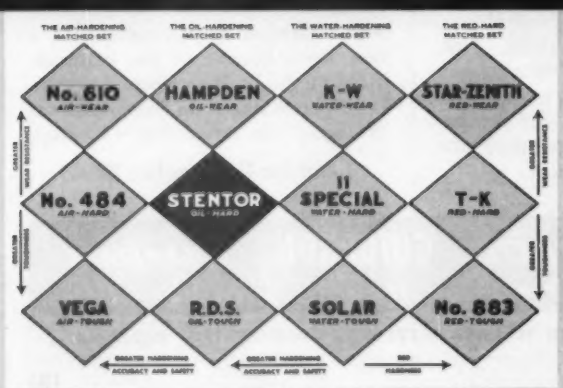
MULTIROL® GUIDEROL® CAMROL
Precision Needle Bearings

McGILL MANUFACTURING COMPANY, INC., 300 N. LAFAYETTE ST., VALPARAISO, INDIANA

now...



Once again, Carpenter Metallurgists prove their desire and ability to pace the field in developments you want and need!



® *U.S. Patent Office*

Like all Carpenter Matched Tool and Die Steels every bar of STENTOR (Oil-Hard) is colored full length in its own distinctive color for quick, positive identification! Immediate availability from your local Carpenter Mill-Branch Warehouse, Office or Distributor.

...*Carpenter* extends the built-in safety factor of STENTOR (oil-hard) tool and die steel!

Remarkable heat treating versatility . . .
safe, dependable hardening through a broad range of 1425°F to 1525°F

The many advantages which make STENTOR one of industry's most used and talked-about steels are affected in no way by this exclusive new development. Its simplified analysis remains unchanged. It is still the *easiest* and one of the *safest* oil-hardening steels to harden. Requires no preheating whatsoever. Hardens from a lower temperature. Assures you less size change and distortion . . . uniform hardenability . . . full freedom from decarburization . . . long, dependable service.

And NOW . . . an extended Built-In Safety Factor enables you to heat treat STENTOR tools, dies and parts either of two ways: (1) At temperatures as low as 1425°F for the cost savings this brings you . . . or (2) Place them right in the furnace with other tools that are heat treated at temperatures up to 1525°F, and eliminate special furnace runs.

If you are not already using Carpenter STENTOR, it's time to *re-evaluate* the *extra* advantages you get with this versatile die steel.

JUST PRINTED! For more facts on how you and your men can Step Ahead with STENTOR, drop us a line on your Company letterhead for this new descriptive folder.

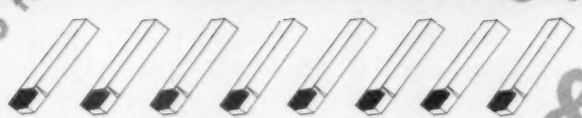
Carpenter STEEL

Matched Tool and Die Steels

The Carpenter Steel Company, 109 W. Bern St., Reading, Pa.
Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

THIS WENDT-SONIS TOOL HOLDER

• • • PLUS ONE INSERT GIVES YOU UP TO 8 CUTTING EDGES



SAVE ON INVENTORY With the wide range of Wendt-Sonis carbide grades and shapes available in throw-away inserts and chip breakers, one tool holder and a stock of inserts can do the work of a much larger stock of brazed single-point tools.

SAVE ON GRINDING With the much lower cost of throw-away inserts, expensive diamond-wheel regrinding is unnecessary.

SAVE ON MACHINE DOWN TIME Because precision-made Wendt-Sonis inserts can be indexed to ±.001", inserts can be replaced without removing tool holder from machine.

FREE TECHNICAL SERVICE in connection with your tooling problems is available from the Wendt-Sonis representative in your area. Ask him for detailed information on Wendt-Sonis tool holders and throw-away carbide inserts or write for Catalog AM-257. Address Department

WENDT-SONIS COMPANY
Hannibal, Missouri • Rogers, Arkansas

NEW SHOP EQUIPMENT

Shaft-Mounted Gear Motor Controls Valves, Variable-Speed Drives

Jordan Shaftrol mounts on shafts from ¼ to ⅞ in. in dia that normally carry crank, lever, knob or handwheel. It is equipped with torque arm or torque plate with resilient mounting that absorbs any runout present in shaft to be controlled. Speeds from ½ rpm to several hundred rpm, and torques from a few in.-oz to several hundred in.-lb are available.

Single phase Shaftrols use instantly reversible permanent split capacitor motor with high starting torque; three phase models are available in larger sizes.

Typical uses are: controlling valves in blending units, automatic remote control of combustion equipment, and automatic tension control.

The Jordan Co, Inc, 3235 West Hampton Ave, Milwaukee 9, Wisc

Glass cloth tape, Permacel 621, is flame resistant and recommended for sealing joints in hot air ducts, exhaust pipes, etc. Tape has high tensile strength and is composed of glass cloth backing and self-extinguishing rubber base pressure-sensitive adhesive mass. Available in 60 yd rolls in various widths.

Permacel Tape Corp, New Brunswick, NJ

Liquid detergent, Oakite Liqui-Det, is concentrated, general purpose cleaner. Containing no soap, it is reported to go into solution instantly and to be effective in both hot and cold, hard and soft water. Concentrations as low as ¼ oz to gallon of water are being used.

Oakite Products, Inc, 24 Rector St, New York 6, NY

Manifold Lube System Centralizes All Grease Fittings at One Point

Low-cost centralized lubrication system consists of one or more manifold blocks, threaded for insertion of standard grease fittings. Blocks are bolted to most accessible location on machine. Rigid or flexible lines connect bearings to inlet ports of manifolds.

System permits lubrication without machine shutdown, prevents accidents and eliminates chance oversights.

Lincoln Engineering Co, 5703-27 Natural Bridge Ave, St Louis 20, Mo

Device Lubricates Strip Stock For Punchpress Operations

Said to work equally well with continuous-coil stock or random-length pieces, strip-feed lubricator for punchpress operations wipes surface of stock free from foreign materials and places a thin film of lubricant on either or both sides of stock. Action is accomplished by an upper and lower oil reservoir, together with two floating felt wipers.

Lubricator reportedly can be mounted in position in a few minutes.

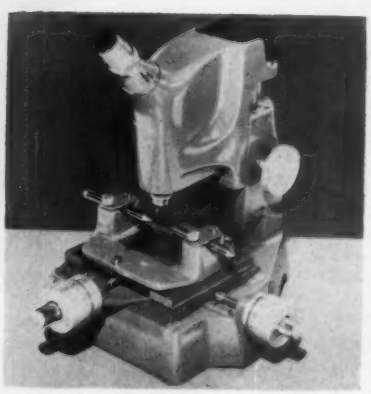
Automation for Industry, Port Crane, NY

Welding electrode, EutecTrode 680 AC-DC, combines two widely used low temperature welding alloys, and produces joints with ultimate tensile strengths up to 120,000 psi. Recommended for use on dissimilar alloy steels and wherever embrittlement must be avoided, electrode provides small grain size welds and high crack resistivity.

Eutectic Welding Alloys Corp, 40-40 172 St, Flushing 58, NY

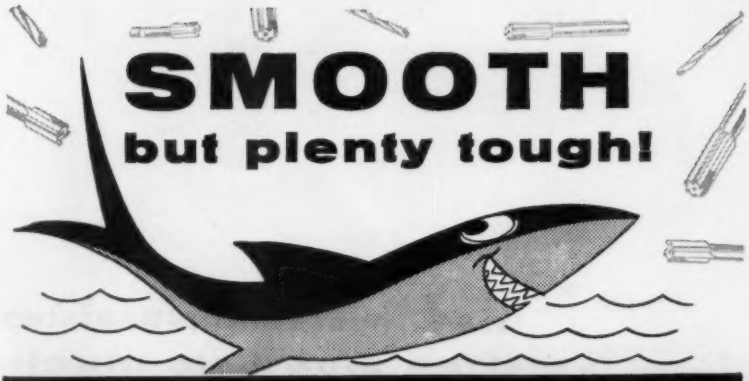
Pipe thread seal, Tru-O-Seal, has a teflon sealing ring molded into threaded locking nut. Suitable for use with oil, water, air, gas, steam, chemicals (except fluorine gas or molten alkali metals) at pressures up to 3000 psi and temperatures from –280 to 500 F. Available in sizes from ⅛ to 2½ in. IPS.

Tru-O-Seal Div of Flick-Reedy Corp, 2040 N Hawthorne Ave, Melrose Park, Ill

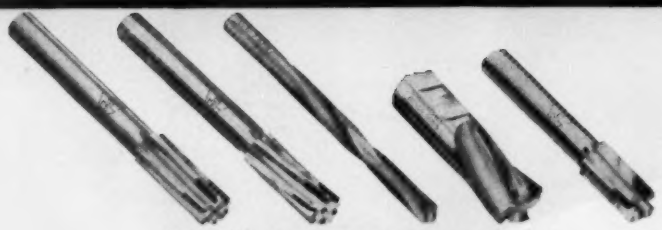


Bausch & Lomb Microscope Has Built-In Illumination

Called Toolmakers Measuring Microscope, device for the inspection and measurement of tools, drill jigs,



WENDT-SONIS tools cut fast and clean . . . stay sharp

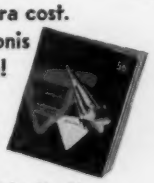


Flo-Finish, an extra process applied to Wendt-Sonis tools after grinding, improves smoothness 30% over ground finishes, permits faster feeds and speeds.

Micro-photograph (below) shows how Flo-Finish (left) eliminates grinding marks (right).

Flo-Finish makes stepped-up production possible because the smoother flutes on round tools permit faster chip flow away from the cutting edges. Tool life is doubled in some applications, because there is less chip friction, less heat.

Flo-Finish is applied to reamers, counterbores, end mills, twist drills, core drills and all other Wendt-Sonis round tools at no extra cost. You save when you use these Wendt-Sonis tools that are extra-smooth, extra-tough! Technical advice on the use of Wendt-Sonis tools is available through your distributors' salesmen.

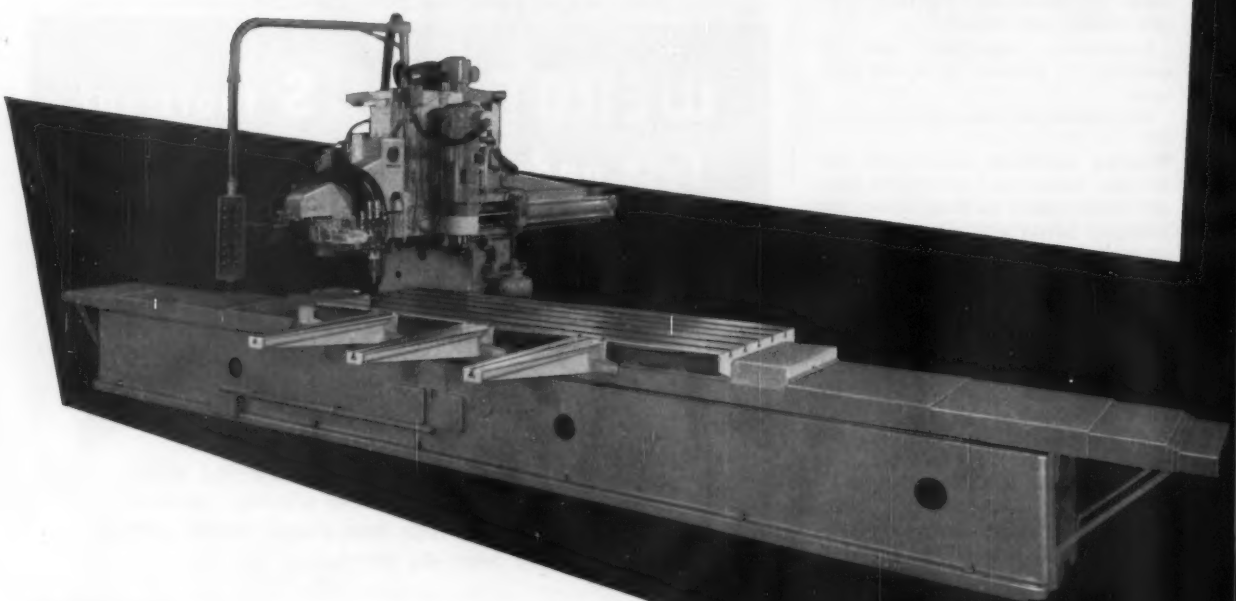


Send for Catalog No. 56—
Address Dept. AM-257

WENDT-SONIS COMPANY

Hannibal, Missouri • Rogers, Arkansas

new hydraulic planer-type **air-frame mill**



for fast, high-precision machining of aluminum air-frame parts

Specifically designed for fast, high-precision machining of variable and complex, 3-dimensional shapes, this new air-frame mill speeds the machining of aluminum air-frame parts. Equipped with a highly sensitive, 3-dimensional hydraulic tracer valve for contour work, the machine also has a depth control valve for 360° tracing. Machining is traced from wood, plastic, metal, plaster of paris models, or actual parts. Available in sizes to 36" x 36" x 10 feet.

Features

30 HP Hydraulic
Counterbalanced Head
Controlled Pressure Lubrication
4-Position Depth Control Turret
Interlocks "To Fail Safe"
Swiveling Pendant
Panel Mounted Valves

Accessories

Telescoping Way Guards
Template-Support Brackets
Spray Coolant for Milling Cutter

QUICK FACTS BY PHONE

Call 3-7611
Rockford, Illinois

Or write direct for a representative to call with detailed specifications.

ROCKFORD MACHINE TOOL CO.

2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

VULCAN Tool Steels get results:

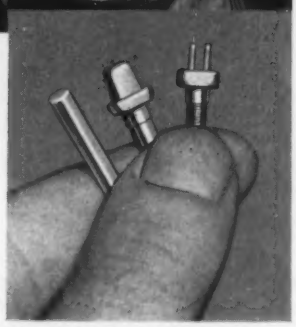
Production up, costs down

A major tool steel user—H. M. Harper Company—recently came up with a real "toughy": Dies for cold heading slotted, hard-to-work Nickel terminal screws. Harper tested steels of various analyses for the application. They found that Vulcan Special Vanadium filled the requirements exactly.

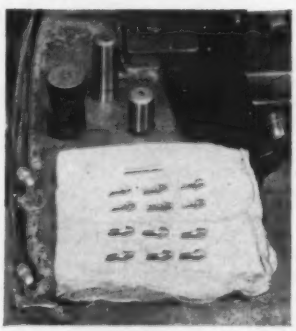
The result—terminal screws produced by cold heading process instead of milling—at very substantial increases in production and much lower cost.

Vulcan representatives *like* tough problems. They welcome highly-demanding tests of Vulcan tool steel superiority. They enjoy tackling a variety of problems, because Vulcan's complete line of fine quality tool steels allows them to give *right answers*—not "almost as good" recommendations.

A representative is nearby to serve you. *Vulcan Crucible Steel Division, H. K. Porter Company, Inc., Aliquippa, Pa.*



VULCAN Special Vanadium used for cold heading dies that are tough enough to produce slotted Nickel terminal screws at H. M. Harper Company, Morton Grove, Illinois.



HKP VULCAN CRUCIBLE STEEL DIVISION
H. K. PORTER COMPANY, INC.

templets, and finished parts is designed to measure in two coordinates. Cross-slide stage has a maximum range of 2 in. in the "east-west" direction and 1 in. in "north-south" direction. The stage itself rests on ball bearings, and its motion is controlled by two micrometer screws.

Illumination source is built in, and the beam of light is directed down through the microscope objective, giving true vertical illumination. A collective mirror under the stage plate reflects light back into the body tube. As a result, both the surface and the contour of parts may be viewed simultaneously.

Standard magnification is 35X, but different objective and eyepiece combinations may be used to obtain other magnifications. Price of the complete basic microscope is $1200. Catalog D-282.

Bausch & Lomb Optical Co, 635 St Paul St, Rochester 2, NY

Bijur Duplex Lubricator Provides Both Cyclic and Continuous Oiling

Duplex unit, designated AP-3, consists of two independent gear pumps with common drive gear, mounted in a single housing, both drawing oil from common reservoir in bottom of housing. It is designed for machines in which some bearings need periodic lubrication; others, continuous oiling.

Each pump has its own inlet and outlet, feeding oil through separate systems to bearings it serves. A Meter-Unit filters and measures oil fed to bearings. Features of system include: continuous branch oil flow constant regardless of oil temperature, no separate power source is needed, special by-pass valves can be adjusted to change delivery, unit can be mounted on any of company's standard reservoirs. Provision is

made for sending oil through cyclic branch when starting cold machine.

Bijur Lubricating Corp, 151 W Passaic St, Rochelle Park, NJ

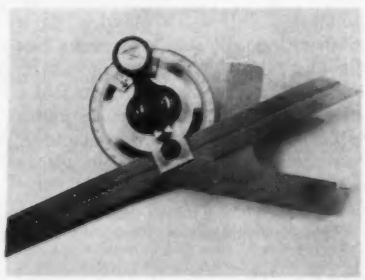
Mobile Industrial Emergency Unit For Plant Disasters

Designed for use in connection with plant disaster and civil defense programs, unit is easily pushed by hand or moved by fork truck. Compartments on one side and both ends hold rubber coats, asbestos suits and blanket, helmets, hip booots, and six fire extinguishers.

Other disaster equipment includes first aid kit, gas masks, rubber gloves, hoses, ladder, lights, and wrecking bars.

Optional equipment includes compartment doors and trailer hitch. Standard unit will cost approximately $3000.

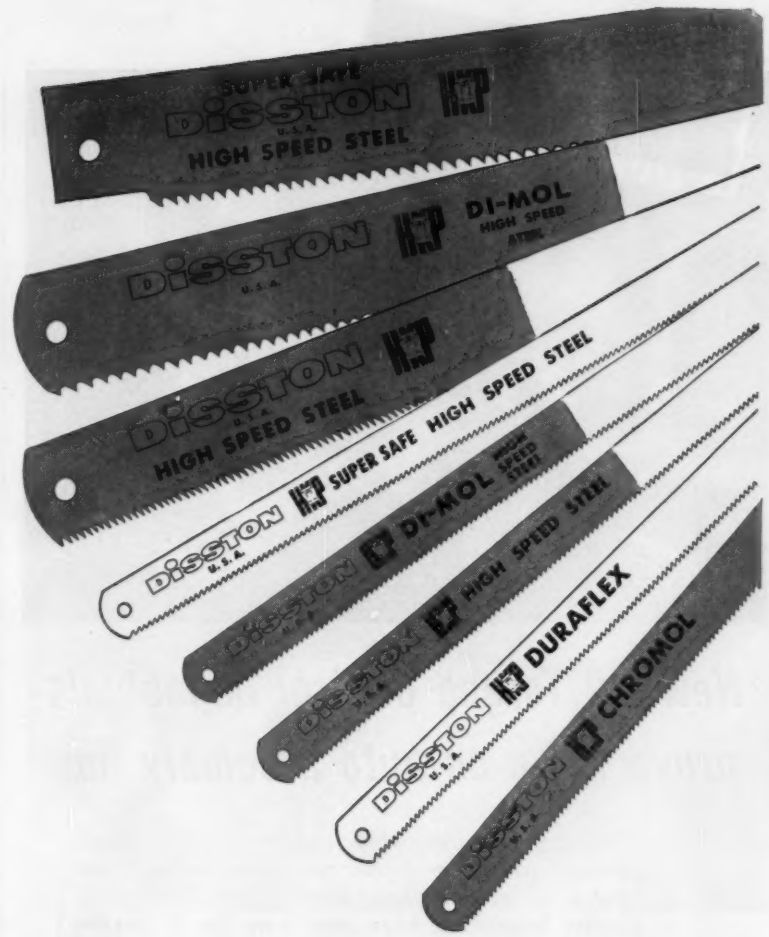
Dana Corp, Parish Pressed Steel Div, Reading, Penna



Scherr Bevel Protractor Measures Any Angle to 5 Minutes

Universal Vernier Bevel Protractor is made of special chrome steel, has hardened blade and clear graduations. Any angle can be read to 5 minutes with vernier. Tool is regularly equipped with 6-in. blade; accessories include 8- and 12-in. blades, acute angle attachment, and stand. Also available in stainless steel. Prices start at $21.50.

George Scherr Co, Inc, 200 Lafayette St, New York 12, NY



For easy, economical machine shop cutting use one of these 8 sturdy

DISSTON
HACK SAW BLADES

They cut easily...resist wear and breakage. Get them through your industrial distributor.

Write for latest folder and hack saw selector today.

Henry Disston Division
H. K. Porter Company, Inc.
Philadelphia 35, Pa.

HKP Henry DISSTON DIVISION
H. K. PORTER COMPANY, INC.

New I-R Torque Control Impactools prove value on auto assembly line

A leading auto manufacturer reports greatly improved *product quality* on 3 auto and truck assembly line operations where Ingersoll-Rand Torsion Bar Torque Control Impactools have been used for 6 months.

A safety hazard is eliminated on one operation, where these new Impactools have made torque control possible for the first time. The photo above shows the I-R Size 5040T Torque Control Impactool securing the steering gear assembly to the truck frame.

Other major benefits include time saving, because these Impactools operate at full power and speed until they automatically shut off when pre-set torque is reached . . . and elimination of the need for hand tor[illegible]many nut running jobs.

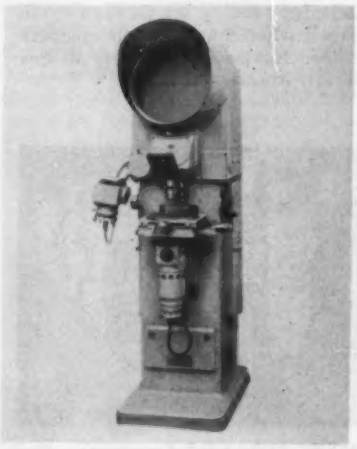
[illegible]40T 2 Torsion bars available with max. torques of 60 and 90 ft. lbs.

Write for the complete story on this latest I-R development!

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

8-346



Nikon Optical Comparator Lowers Inspection Costs for Small Parts

Featuring Nikkor lens system that produces extremely bright, evenly illuminated viewing image, this Japanese comparator, product of Nippon Kogaku K K, Tokyo, permits rapid examination of tolerance limits, hard to measure dimensions and critical points. Position of light source can be varied to give outline image or surface topography. Six different magnifications are available, ranging from 10X to 100X. Accessories include: micrometer stage, protractor screen, surface smoothness detector, photographic kit. Also available in bench models.

Dist by Nikon, Inc, 251 Fourth Ave, New York 10, NY

Lubricant, called Permawick, is a self-wicking, liquid lubricant that fills any size sleeve bearing cavity. It is combination of oil and cellulose base fibers, will not separate under injection pressure. Injection machine, Permajector, meters injection within ½%.

Fluidwick Co, 5319 E Outer Drive, Detroit 34, Mich

Scriber, called Micro-Scriber, can scribe or etch all metals, glass, plastics, gems and ceramics. Solid carbide tip is diamond ground and precision lappd, and is secured within tool. Price is $1 per tool.

Greist Mfg Co, New Haven 15, Conn

Valve reclamation service restores valves of all types to new-valve operating condition. Valve is disassembled, sand blasted, and necessary replacement parts are added.

Lynch Engineering Co, Inc, 110 Valley Rd, Wilmington 4, Del

Free Literature

To order any of these bulletins, please use cards at start of this section—page 160a.

MACHINES AND ATTACHMENTS

34 ABRASIVE CUTTING MACHINES—*Campbell Machine Div, American Chain & Cable Co, 929 Connecticut Ave, Bridgeport 2, Conn.* 4-page bulletin DH-460-B describes fully automatic and semi-automatic units for both dry and wet cutting. Twelve models illustrated; applications outlined; specifications and engineering data provided.

35 SURFACE GRINDING APPLICATIONS—*Mattison Machine Works, Rockford, Ill.* Booklet contains 14 illustrated case histories of difficult or unusual applications being performed by leading metalworkers.

36 METAL DISINTEGRATOR MACHINE—*Cammann Manufacturing Co, 2700 Henninger Rd, Cleveland 9, Ohio.* Literature provides illustrated description of two models that disintegrate any shaped hole in hard metals. In addition to removing broken taps, bushings, etc, machine can be used for cutting dovetails in tools and dies, new centering holes in taps, and similar operations.

37 INCLINING DEVICE FOR PRESSES—*Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY.* Illustrated supplement 56-57-58 gives data on air motor inclining device available as optional equipment on Niagara Series E, A, and AA OBI presses (45 to 200-ton models). Mechanism inclines or brings press upright over full 30° range in approximately two minutes.

TOOLS AND ACCESSORIES

38 "HANDBOOK OF METAL SAWING"—*W O Barnes Co, 1297 Terminal Ave, Detroit 14, Mich.* 36-page revised edition covers proper selection and use of hand and power hacksaw and bandsaw blades. Recommended cutting speeds, feeds, and techniques tabulated. Covers common metal-cutting problems and solutions.

● CARBON BRUSHES FOR ELECTRIC TOOL MOTORS—*Ohio Carbon Co, Dept 219, 12508 Berea Rd, Cleveland 11, Ohio.* 34-page illustrated catalog 219-C describes 250 brushes covering more than 2000 different applications. Request direct on company letterhead.

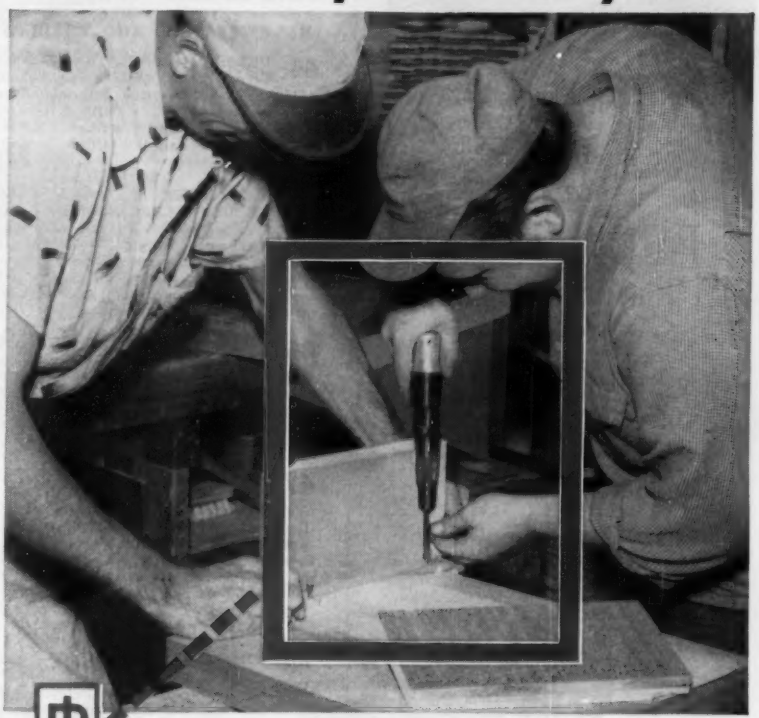
39 AUTOMATIC GEAR CHECKER—*Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich.* Bulletin 481-A describes features of equipment, its operation and capabilities. Designed particularly for aircraft and special-purpose spur gears, unit measures and records parallelism, tooth taper and spacing. Readings are automatically and permanently recorded.

40 TAP DRIVERS—*Scully-Jones & Co, 1901 S Rockwell St, Chicago 8, Ill.* 8-page bulletin 20-50 illustrates and describes Safe-Torque drivers, including standard, tension and compression, and quick-change types.

41 PROCESS CONTROL INSTRUMENTATION—*Fischer & Porter Co, 907 Jacksonville Rd, Hatboro, Penna.* 32-page catalog 2 pictures and gives details on indicating, recording, controlling, and transmitting instruments for flow, pressure, and density.

42 SINGLE-PASS ACME TAP—*Horspool & Romine Manufacturing Co, 5850 Marshall St, Oakland 3, Calif.* 4-page illustrated catalog describes features and gives complete list of stock sizes from ⅝ to 2½-in.-dia.

is there a COST-SAVING idea in this picture for you?



air-powered screw drivers end handwork in close quarters

*Exceptionally small side-to-center distance of this Ingersoll-Rand air-powered screw driver permits running screws that electric tools can't reach and that formerly had to be driven by hand.

AIR engineering at work
REPORT No. 4211.05

The men pictured above are saving $1.35 on a single unit. That's a saving of $87.75 a day for their company. Production has increased 160% since the two men changed from a combination of electric tools and hand methods to I-R Air-Powered Screw Drivers. At this rate, the I-R tools *paid for themselves in 3½ days!*

Can you picture a similar saving in your plant? An I-R AIRengineer, with over 1000 sizes and types of air and electric tools to work with, will gladly analyze your assembly operation and make recommendations without obligation. Write today!

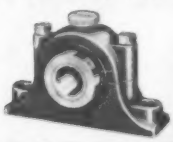
Ingersoll-Rand

8-507

11 Broadway, New York 4, N.Y.

FLEXIDYNE
THE DRY FLUID DRIVE
100% efficiency at full load!

TORQUE-ARM
SPEED REDUCERS
Cost less—deliver more!



DODGE-TIMKEN
America's Quality Pillow Blocks!

●

DODGE BULLETINS YOU SHOULD HAVE—

- Flexidyne Dry Fluid Drives and Couplings. Bulletin A-640-A.
- Torque-Arm Speed Reducers. 15 sizes—1 to 90 hp. Bulletin A-637.
- Roller Bearings. Load ratings, dimensions, etc. Bulletin A-638.

Write for your copies.
DODGE MANUFACTURING CORPORATION
100 Union Street • Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

Free Literature

43 LUBRICANTS FOR STAMPING & DEEP DRAWING—*Magnus Chemical Co, Garwood, NJ.* 4-page bulletin 138 provides data on line of lubricants, description of properties, specific applications. Chart lists recommended lubricant for different operations.

HEAT TREATING AND WELDING

44 PRESS WELDER—*Taylor-Winfield Corp, Warren, Ohio.* 8-page bulletin 3-513 presents illustrated information on standard size 3½ Type EQB that meets welding requirements between RWMA standard sizes 3 and 4. Features, controls, accessories covered.

45 RESISTANCE WELDING ELECTRODES & ACCESSORIES—*Ampco Metal, Inc, 1745 S 38th St, Milwaukee 46, Wis.* 28-page bulletin RW-10 describes complete line; gives specifications and dimensions of standard welding tips, wheels, dies, and holders, adapters, couplings, seam welder shafts, and bushings.

46 HEAT TREATING UNITS—*Ipsen Industries, Inc, 715 S Main St, Rockford, Ill.* 4-page illustrated bulletin T-19A gives information on automatic "A" Model 100% forced convection units for carburizing, carbonitriding, and hardening. Engineering data, specifications included.

47 TEMPERATURE CONTROL OF HEAT TREATING FURNACES — *General Electric Co, Schenectady 5, NY.* Illustrated publication GER-1206 (21 pages) consists of series of six articles covering basic temp control system, thermocouples and control instruments, control elements, and special control systems.

PLANT SERVICE EQUIPMENT

48 FINISHING EQUIPMENT—*Osborn Manufacturing Co, 5401 Hamilton Ave, Cleveland 14, Ohio.* 20-page folder illustrates and describes Brushamatic finishing. Machines are designed for semi-automatic, automatic, or fully automated finishing. Brushing tools covered.

49 LP-GAS FUEL SYSTEMS—*Hyster Co, 2902 NE Clackamus St, Portland 8, Ore.* Illustrated specification sheets describe systems offered for Hyster-built trucks ranging up to 20,000-lb load capacity. Features, advantages, performance figures discussed.

50 POWER ROOF VENTILATORS — *American Blower Corp, Detroit 32, Mich.* 8-page illustrated catalog 3904 describes construction, operation, and design features of each of four models in improved line. Performance data, dimensions included.

51 BENCH COMBINATIONS—*Pollard Bros Mfg Co, Chicago, Ill.* Illustrated catalog 304 covers benches for individual and continuous applications. Units are available in 126 different combinations, in three basic styles with variety of top sizes and heights.

PARTS AND MATERIALS

52 ENCLOSED SWITCHES — *Micro Switch, Division of Minneapolis-Honeywell Regulator Co, Freeport, Ill.* 24-page catalog 77 covers standard line for airborne applications and for use in other types of commercial applications. Wide range of units illustrated and described.

53 ULTRASONIC GENERATORS & TRANSDUCERS—*Acoustica Associates, Inc, Glenwood Landing, LI, NY.* Bulletin DR-2000 describes high-power units adaptable to practically any type of tank configuration and dimension; can be applied for powering large scale, high-volume batch or automated ultrasonic cleaning, machining, and liquid processing systems.

Free Literature

54 STEEL TUBE FITTINGS—*Weatherhead Co, 128 W Washington Blvd, Fort Wayne, Ind.* 48-page catalog contains engineering data, specifications, assembly instructions, materials, finishes, and operating pressures.

55 STAINLESS STEELS — *Allegheny Ludlum Steel Corp, 2020 Oliver Bldg, Pittsburgh 22, Penna.* 8-page Blue Data Sheet on chromium-nickel-manganese types 202, 204, and 204L, a new group of austenitic stainless steels with very good mechanical and corrosion-resisting properties; gives detailed information on intergranular corrosion, mechanical properties, analysis, and stress rupture properties.

56 VALVES — *Lunkenheimer Co, Cincinati 14, Ohio.* 24-page illustrated "Guide for Selecting Valves, Boiler Mountings, Lubricating Devices" has been revised to include sections describing new valves. Tables, technical data, and information are indexed in this new edition of Circular No. 555.

57 ALLOY SELECTOR GUIDE—*Techalloy Co, Rahns, Penna.* Chart gives vital data on comparative strengths at high temperatures, scaling resistance, individual characteristics. Alloys covered are Inconel, Inconel X, Incoloy, Techalloy 80 Ni 20 Cr, stainless and heat-resisting steels.

ROUND TABLE *Discussion*

LOAN SHARK

Is it or is it not the foreman's business if one of the men in the shop is lending money to other workers and charging interest? If the borrowers are not complaining, and production is not affected, has the foreman any right to interfere?

A LOAN SHARK in the shop is a man with a purpose, a purpose all his own. He is there to beat the men out of as much as he can. The other men are there for the primary purpose of production, shop production. The usurer's primary purpose is production of illegal profits for himself. To him company work and shop production is secondary and just an excuse for his presence in the shop.

The loan shark is a hateful person who profits on human misery and the problems of his fellow men. People deal with him as a last resort and always in an antagonistic, resentful manner. His presence in the shop throws a veil over the whole group, dampening the spirit of the men and interfering with the all-important attitude of cooperation and helpfulness. The loan shark's

NO REBORING—

NO KEYSEATING—

NO MACHINING—

NO WAITING!

TAPER-LOCK SPROCKETS
SINGLE AND DOUBLE STRAND!

NOW Taper-Lock *Double* Strand Sprockets are available—from stock—ready for the shaft without re-machining!

They offer all the advantages of Taper-Lock mounting. Easy on! Easy off! Precision machined at the factory, they come to you with accurate, concentric bores —insuring full contact between hub and shaft. Taper-Lock grips with the firmness of a shrunk-on fit!

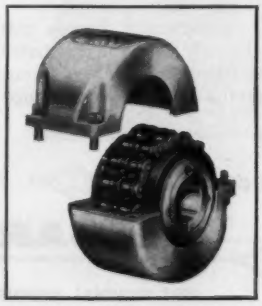
There is no flange, no collar, no protruding part. Flush design means *safety*... If the sprocket becomes worn, you replace only the tooth part. The bushing is used again and again. And Taper-Lock bushings are interchangeable in Dodge Taper-Lock Sheaves, Couplings and Conveyor Pulleys!

Taper-Lock Sprockets and Dodge Roller Chain (made to ASA standards) are stocked by Dodge distributors. Single Strand sizes range from No. 40 to No. 160, up to 112 teeth; Double Strand from No. 40-2 to 80-2, up to 102 teeth. Write for Bulletin A-644 containing selection, installation and maintenance data.

DODGE MANUFACTURING CORPORATION
100 Union Street, Mishawaka, Indiana

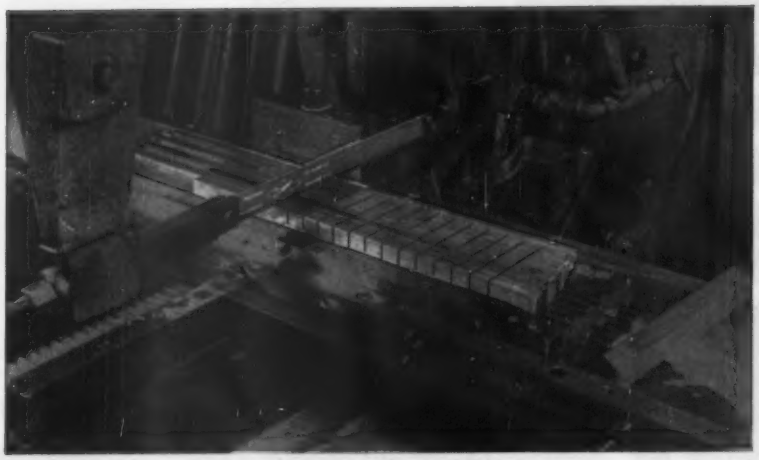
DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new methods. Look for his name under "Power Transmission Machinery" in your classified phone book, or write us.



TAPER-LOCK CHAIN COUPLINGS

Accommodates common minor shaft misalignments. Provides strong, compact coupling. Available with covers, for appearance, safety, dirt protection and lubrication — which increases coupling life.



F. Jos. Lamb Co. now uses Barnes Rocket Hack Saw Blades for low cost slotting operation.

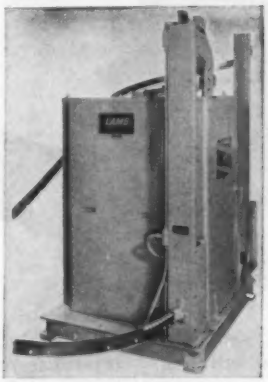
BARNES

POWER HACK SAW BLADES

SAVE $360.00 PER DAY

Slotting a set of 8 support arms was costing the F. Jos. Lamb Co. $60.00. The problem was presented to a Barnes' field engineer. He gathered the facts, including one that Lamb was seriously considering the purchase of new equipment for the job costing approximately $2,000.00.

The Barnes engineering department, after thorough study, recommended that the slotting be done by hack sawing. Barnes Rocket Blades, RT 1406-6, would give the correct slot width and insure straight, accurate cuts. A special fixture was designed adapting one of Lamb's hack saw machines (Cost: *less* than $200.00).



F. Jos. Lamb's new Stor-Matic Hitch-Lift is placing automation within the reach of all manufacturers. The Stor-Matic automatically stores and feeds semi-processed parts between standard machine tool operations.

The result—production of 4 sets for the previous cost of 1 set. Based on two shifts, this is a savings of $360.00 per day. In addition, F. Jos. Lamb Co. is obtaining more cuts per blade from Barnes Rocket Hack Saw Blades and immediate delivery from the stock of their local Barnes distributor.

The services of an experienced Barnes metal cutting engineer are available to you through your Barnes distributor. His recommendations on your hand, power or band saw requirements will increase your production and lower costs. Call your Barnes distributor today.

when cutting counts BARNES *count on Barnes*

W. O. BARNES CO., INC.

1297 TERMINAL AVENUE DETROIT 14, MICHIGAN

stock in trade is coercion combined with violence and threats of violence.

The employees in a shop do not function as completely independent individuals, they function as a team working together, helping and teaching each other. The presence of a single individual at odds with the group can weaken and break these ties and interfere seriously with the smooth operation of the shop. The foreman has but one alternative; he should make every effort to eliminate this serious detriment to the success of the organization.

Clifford Molloy
New York, NY

A LOAN SHARK in the shop! What is so serious about that? Does the foreman expect the men to be of a different nature inside the shop than they are outside?

The loan shark is one of the consequences of society and our way of life. It is not necessarily a disease that we all want to see stamped out. The loan shark exists because we are all human and subject to human failings. We are members of an acquisitive society and have a great desire for physical possessions. Our desires usually exceed our earning power and occasionally we may be short of funds.

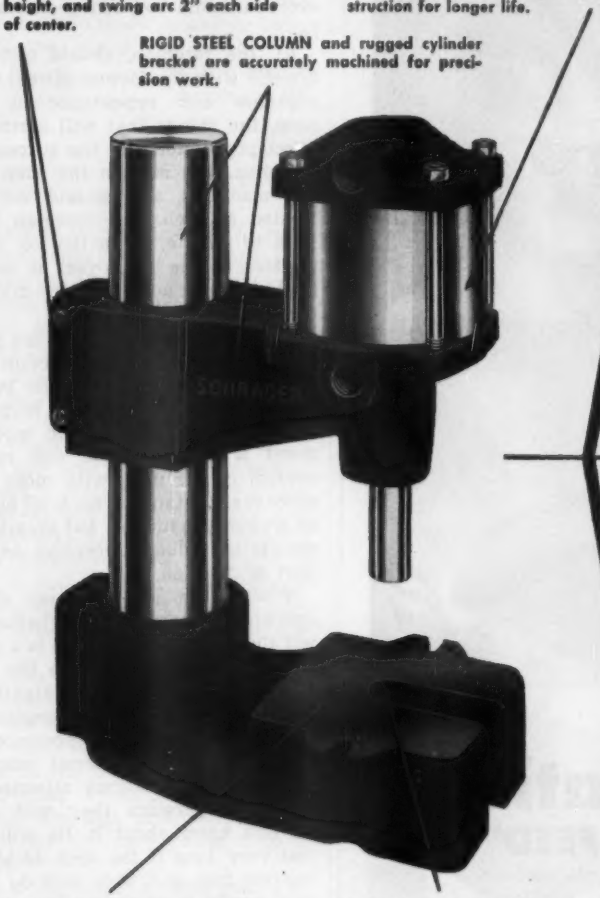
Having such an operator right in the shop is real handy and saves the men a trip to the local pawn broker or to some neighborhood bar where they can get a loan at equally high rates. True, the loan shark's charges

"Goulter's heard that the company's expanding . . . he just beat them to the draw!"

TWO-BOLT CLAMPING adjusts easily, positively from 0" to 7" in height, and swing arc 2" each side of center.

HEAVY-DUTY CYLINDER with extra heavy wall, tie rods and piston construction for longer life.

RIGID STEEL COLUMN and rugged cylinder bracket are accurately machined for precision work.



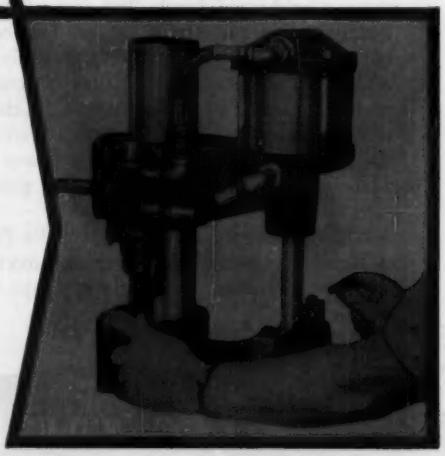
HEAVY, RUGGED BASE forms sturdy foundation for large machined-surface table area.

SPECIAL RECESS IN TABLE provides for punch-through operations.

NEW SCHRADER AIR PRESS

It's compact and power packed!

It stamps, coins, broaches, rivets, stakes, presses, shapes, bends, assembles—*many other uses!*



Modern "muscles" of compressed air never tire . . . get more work done at less cost!

This modern Air Press has unlimited possibilities for speed, power, positive performance. Available as single acting for impact jobs; double acting for squeeze and power withdrawals. It requires minimum space, next to no maintenance, is extremely versatile in adapting to operating controls. Can't be beat for low cost practicality.

Important feature: Control and speed of the extra heavy cylinder and ram can be varied as necessary, by using standard Schrader Air Control Accessories that adjust in seconds.

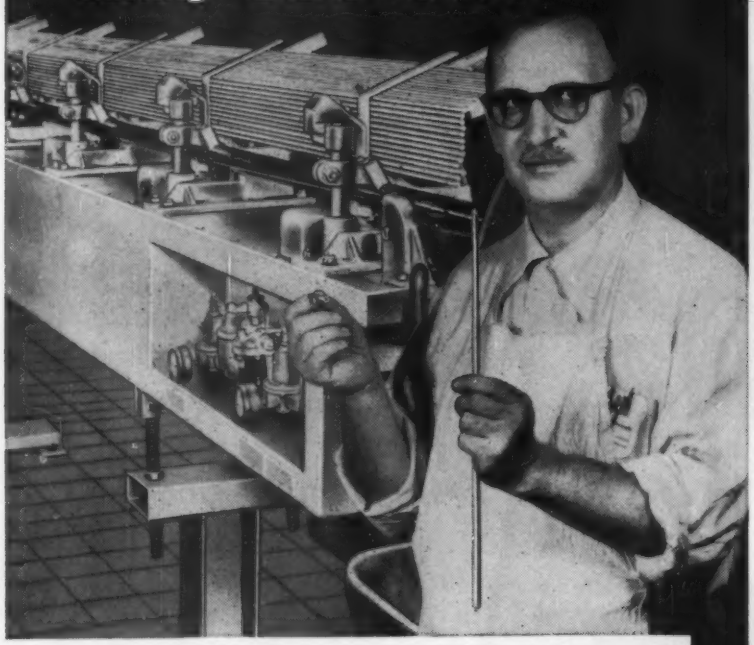
Write for Catalog data describing Air Press fully—including variety of controls, accessories and prices. You'll be surprised at the low prices!

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
460 Vanderbilt Avenue, Brooklyn 38, N. Y.

Schrader®
ESTABLISHED IN 1844

LEADERS IN AIR CONTROL SINCE 1844

"Stop Cutting Air and you Start Cutting COSTS...



Just equip with

LIPE Automatic

MAGAZINE LOADING BAR FEED"

Says Foreman Billy Smathers*

"We put in two Lipe AML Bar Feeds as a test," explains Foreman Smathers. "At the same cutting speeds as our other screw machines, the AML-fed machines turned out the two pieces I hold in my hands, 78% faster for the small ⅞" piece, and 108% faster for the 16" piece. That opened our eyes . . . but quick! Yet the reasons were perfectly obvious. The Lipe AML's fed stock without pausing. No cutting air. No repeat motion for feed-outs. No down-time for changing feed fingers, or for remnant disposal. The AML's geared our production to the steady pace of the clock . . . so many units of output per so many units of time. Overall, the gain was astonishing!"

WRITE OR WIRE for a FREE Lipe Sales Engineering estimate of production increases, savings and amortization time of Lipe AML Bar Feeds in your production layout.

* Photographer's models and pseudonyms used to protect company identity and confidential information.

Lipe-ROLLWAY CORPORATION SYRACUSE 1, N.Y.

Machine Tools • Heavy-Duty Automotive Clutches • Portable Power Hack Saws

are high, but the service is fast and convenient. The high interest rate prevents some of the men from going overboard and borrowing excessively.

Al, the foreman, should concern himself with the factors of real consequence and importance in the shop, the things that will seriously affect production and the success of the shop. The men in the shop are not machines and should not be treated as such. The foreman who tries to dictate the policy on such matters to the employees is not a leader of men; he is a narrow-minded dictator.

There is little enough in the shop that can be left to the discretion and judgment of the man at the bench or the machine operator. Why reduce it still further? The modern trend is toward closer and closer control of the men, with more and more regimentation. This is all aimed at greater production, but invariably results in reduced incentive on the part of the men.

Whether or not the loan shark operates in the shop and whether or not the men patronize him is a matter that should be left to the employees. Such a decision rightfully belongs to them. If the employees resent and object to his presence because of the high interest rates or because of the stigma attached to such an operation they will soon let him know about it. He will not last very long if the men decide to boycott him and they will do it if they really want to see him out. It may mean taking his business by making an occasional friendly loan to each other to make it unnecessary

"Busy, Milton?"

to patronize the loan shark.

Al should devote his time to the important problems of the shop and leave the loan shark to sink or swim as the men see fit.

William Martin
Brooklyn, NY

IF THERE IS no complaint to Al from the men about Mills' Shylock proclivities I don't think Al should stick his neck out. If the transactions are carried out during working hours, the whole thing is highly irregular, even reprehensible, but it seldom pays a foreman or his company to fish in troubled waters.

Al would be well advised to listen to Ed and turn a deaf ear to rumor. He says it is illegal for Mills to put his money out to usury to the men and perhaps he is right, but Al is not a policeman, he's a foreman, and if he is satisfied that Mills' money-lending activities don't interfere with production or with normal shop discipline, I think he should forget about the matter.

It could be, of course, that the deals are carried out by Mills during meal hours or even out of working hours on the way to and from the plant. That would be entirely out of Al's province and would be a matter for the civil police if it is illegal.

Al, to my mind, is here posing as a purist and purist foremen are usually objectionable fellows whom nobody loves. I once worked for one and, believe me, it wasn't a pleasure. He liked to impress on all of us that he was so scrupulous of the company interests that he carefully divested himself, each night, of all company property before going home, in order that it might not be used by him in his off hours in his own, instead of in the company's interests. Pen, pencils, rubber, notebook, etc, all were locked in his desk overnight in order that they might not be used at home. This is not an amusing fiction, it is an uninspiring fact.

Nonetheless, I have little sympathy with people who habitually borrow money or anything else, for that matter. They usually are thriftless and improvident people. Some years ago, when Mr. Stanley Baldwin was prime minister of Great Britain, the House of Commons was debating a bill designed to tighten up regulations against bogus share pushers, confidence tricksters, and other elements of ill repute. In winding up

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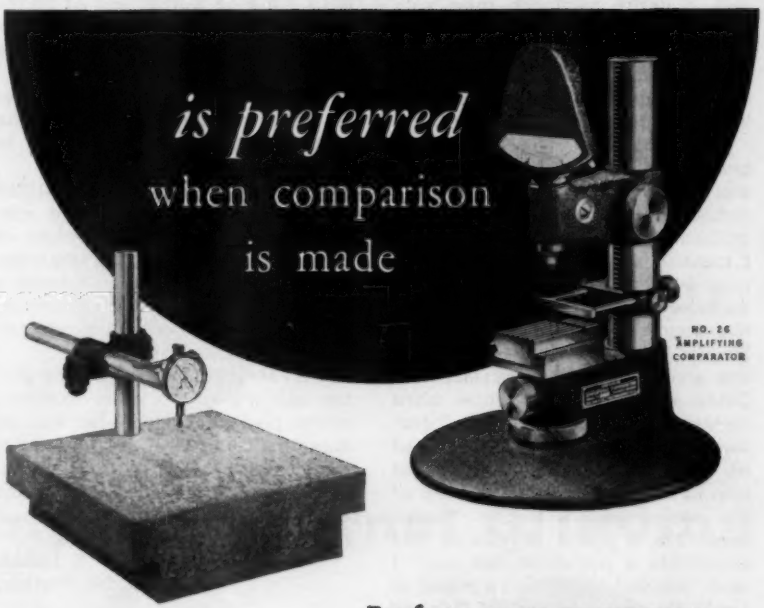

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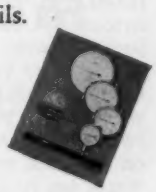

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the debate he wisely observed "So long as there are people anxious to get rid of their money there will always be gentlemen willing and anxious to relieve them of it."

If some of the men on Al's squad are anxious, with their eyes open, to pay Mills an exorbitant rate of interest for a loan, who could blame Mills for cashing in? I should say he is just the lesser mug. In all plants where I've worked there have been peddlers. I suppose it springs from the very human desire to have a little business or a little gamble of their own, a desire to match their wits against those of their fellows. Some I have known made surprisingly little out of it; painstaking, plodding fellows who seemed to go to endless trouble to reap a paltry reward.

One graying, semi-skilled man, quiet, affable, and efficient at his job, was often noticed by me to be absorbed in the pages of a sporting publication which catered to punters. I mentioned the matter to his foreman who told me "Alec is an old bachelor who lives alone in a little house and he puts on a bet every day. He also keeps an accurate profit-and-loss account of all his transactions." Later, on passing his machine when he was immersed in his "bible," during a long cut, I leg-pulled him about his profit-and-loss account and asked him how he made out at the end of the racing season. Reply: "Sometimes I'm a pound or two in and sometimes a pound or two out." I said, "All that trouble for a pound or two?" He smilingly replied "It's my hobby, I get a great kick out of it even if I don't make much money."

Punters like Alec differ from peddlers like Mills but they are of the same genre. Another, a lean, lanky fitter, could always be relied on to supply cigarettes to the improvident and collect the dough on Friday pay day. He had no license to sell tobacco, bought wholesale, kept a large stock in his house and added a percentage for service.

Peddlers multiplied in all factories during the war period when shortages alone were plentiful here. Suitlengths of cloth, kitchen utensils, nylons, the list was endless as the peddlers were numerous. So far as management could see, neither shop discipline nor production suffered so we turned a blind eye. Much of the racket took place during meal hours, on all shifts, and no one seemed the worse for it.

I always aim at a high standard of shop discipline tempered with a little humanism; I never expect to get perfection in human beings. None of us ever reaches that high standard and I honestly believe that a little bit of what we fancy does us good, even if it is not strictly orthodox. So long as those little human weaknesses are not allowed to run riot, not allowed to encroach on one's broad duty to the company, the fact that they are winked at by the powers that be is always appreciated by the best elements in the shops and is seldom played on by them. When that feeling pervades a plant, employee-employer relations are good and both stand to gain.

We have Ed's word for it that Mills is a good worker and Al makes no complaint about him on that score. In the circumstances, I think Al should let sleeping dogs lie. Mills' misdemeanor is a harmless one so far as the company is conerned; the legal aspect can safely be left in other hands.

Al would certainly not be justified in firing Mills unless he had convincing proof of neglect of duty or breach of contract. If he is uneasy about the matter he should make a report to Harrison, but grapevine information would not be sufficient evidence for a chief to act on.

If Al keeps a sharp eye on the gentry who are out to make trouble—every plant has them—he will be doing his company a greater service than fooling around with minor indiscretions which a good charge hand could easily check if they became a nuisance.

C Donald
Lanarkshire, Scotland

WILL A LOAN SHARK in the shop help the organization attain its purpose of existence? Without a doubt the

"I'm so sorry, who ever you are."

E. F. HENNIS
New York

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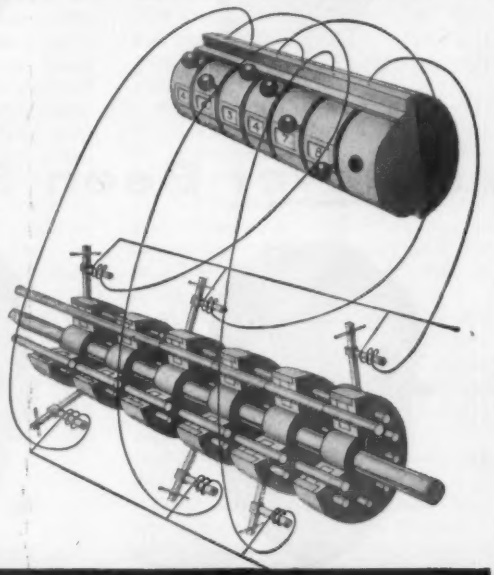

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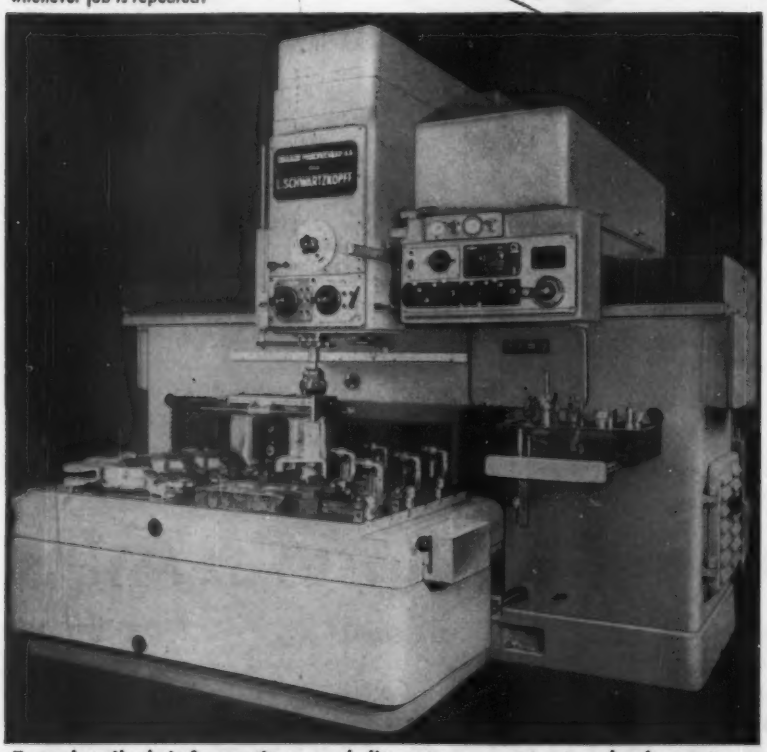

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presence of such an operator will be detrimental. The men may find that they can make use of such a service but they will not be very happy about the high interest rates. They will do business with him but they will hate him. The men will lose production time while they are conducting business with the loan shark.

And how about the money lender, he will be paying more attention to conducting his illegal business than to the company work. The ill-will, antagonism, and perhaps threats of bodily harm which would result when an employee could not or would not meet his payments would not improve the harmony and co-operation in the shop.

If the company permits this man to operate it will not be long before some of the other employees seize upon the opportunity of using the factory as a market place. There are plenty of little operations that they can set up and operate at a profit. As long as the company is paying their wages for their time, anything they make on the side is so much gravy. They will soon be busy selling tools and jewelry as well as taking bets on the races and the numbers racket. Activities of this type can make a deep, malignant, cut into the profits of the company. Once these activities are allowed to take root and propagate, they get a good grip in the shop and it becomes extremely difficult to stamp them out.

The best way to eliminate the undesirable loan shark is to set up a credit union. He cannot hope to compete with an employee-operated, non-profit organization. The usual practice is for the credit union to function during lunch periods. This

"Puts in a lot of hours, doesn't he?"

operation is invariably conducted by volunteers or elected officers who serve without pay. There are national associations who provide a wealth of information and assistance to groups who wish to establish credit unions. Credit unions have proven themselves to be practical in both large and small organizations.

Ernest Jones
Bronx, NY

HERE WE GO again with the interfering foreman. He is always looking for trouble.

The responsibility of the foreman is to keep costs down and increase quality output. He is also responsible for good work habits. If the employee is a good workman I would not try to change his personal habits unless it affects his work or that of other employees.

The foreman who looks for trouble will find his credit is always good. Let this hot potato alone unless someone complains. It is none of the foreman's business who the employees borrow money from, or the terms of the loan.

In this case we must consider the source of information—the foreman's pet busybody. It is possible he was shooting off his mouth. The foreman would cause resentment and discord by interfering.

A E Salmons
Norristown, Penna

THE TALE OF THE SHOP "loan shark" brings to mind a similiar situation within my experience where toleration of a "harmless" private loan business in the shop led to quite a headache for the foreman who condoned it.

This foreman knew that one of his men loaned money to other workers at a stiff interest charge. He did nothing to stop it on the basis that it was his practice never to mix in the private affairs of his men. He figured that if a man wanted to borrow some money from a fellow employee to tide him over an emergency, that was his own business. It was no racket when a man helped his friends in the shop in a tight money situation. What could be wrong with a fellow employee lending the needy worker some money until payday? The foreman figured that helping the needy would stop them from going elsewhere and getting involved with high interest.

What he overlooked was the in-

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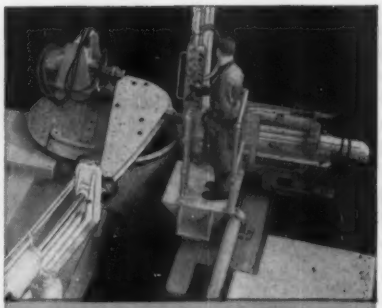
herent danger to himself as a foreman in condoning a private racket in his own backyard. For the inevitable did happen, and rumors got around that the shop loan shark split the profits with the foreman. Whether this was true or not, the fact that the foreman allowed this practice gave rise to the rumors. He virtually cut his authority out from under his own feet besides getting a dressing down from the super for his laxity.

There should be no room in a shop for an "Honest John" or "Big-Hearted Joe" who lends money to the men when they're broke, and charges them 10% a week interest. The best practice to follow when the home-grown loan shark makes his presence known in the shop is to call him on the carpet and lay down the law. Make him promise to stop the vicious racket or face dismissal. Point out that lending money at interest to other workers is strictly against the rules. A foreman can't shut his eyes and say that kind of sharp practice isn't going to hurt anyone. It's poor policy to permit a private loan setup in the shop because it interferes with work and disrupts the foreman's authority. It is usually usurious, with no control on interest charged for loans. Or it can become a shakedown racket if the worker is unable to repay the money and must continually pay high interest.

The best course to follow, when a worker needs an emergency loan, would be to refer him to the personnel department. This department in handling personnel welfare problems would be able to come up with a better solution than the shop loan

"I know you didn't ask for a transfer . . . it was my idea."



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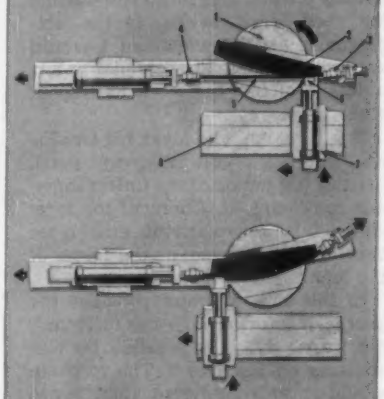

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3. Table Gripper
4. Main-ram Gripper
5. Work Piece
6. Compression Wipe Shoe
7. Hydraulic Compression Carriage
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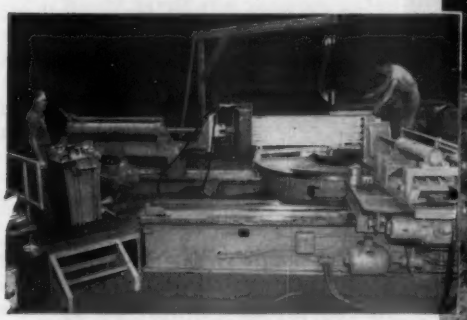

AT DOUGLAS. Anti-icers, retainer seals, canopy rails, and many other parts for RB 66C, B 47 are Radial Draw Formed. DOUGLAS-TULSA STAFF PHOTO.

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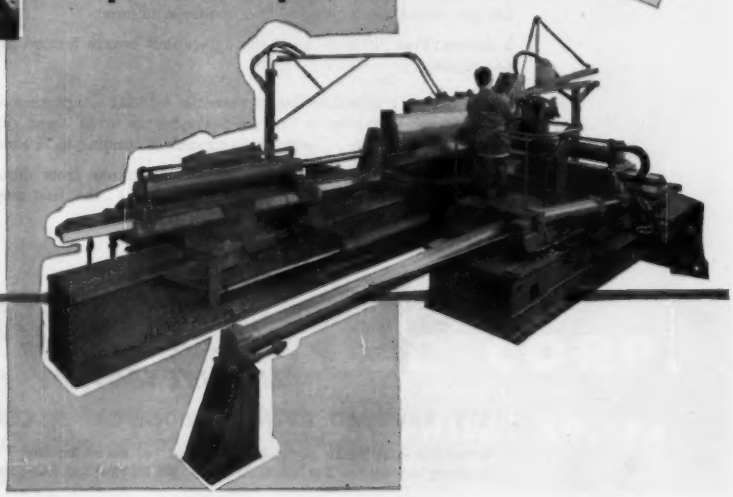

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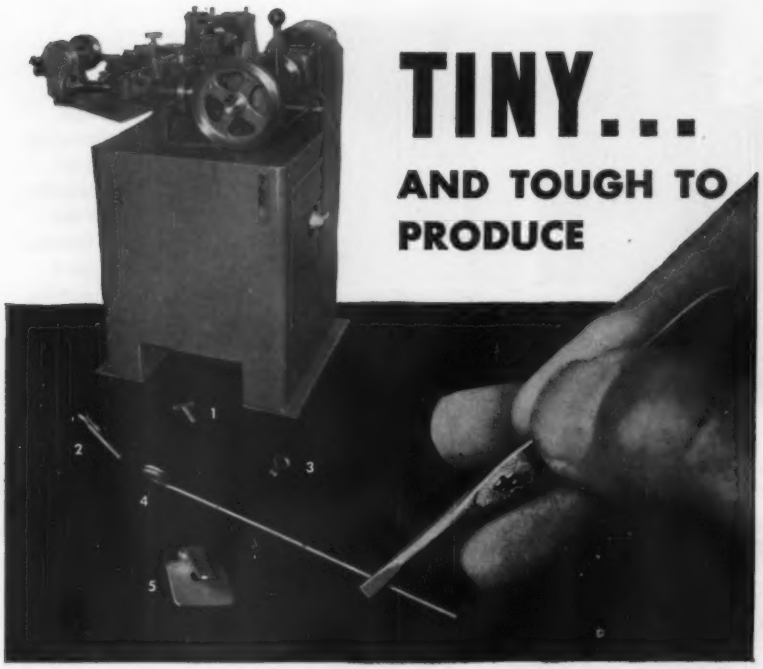

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shark. A company loan to tide the worker over the emergency situation, and to be repaid out of earnings in installments to the company, could be arranged.

Another constructive contribution to the financial welfare of the workers, and one that will eliminate loan shark proclivities in the shop, is for management to help its employees to set up a company-sponsored savings and loan association. The workers under this borrowing and saving system save money together to provide capital to lend each other for emergencies and useful purposes. Loans are made at low cost and savings pay good returns. Worker efficiency will rise, unhampered by financial anxiety. The workers will have a way to save money regularly and a place to turn for sympathetic financial help. There will no longer be a place in the shop for a usurious loan shark.

Harry Kaufman
Philadelphia, Penna

IT IS ONLY NATURAL to assume that if a man is careless with his own money he's likely to be indifferent to the welfare of the firm for whom he works; however, that is not always the case. Some individuals are so considerate of others that they ignore their own welfare and soon find themselves in a financial bind as a consequence. In this case it is their unselfishness that eventuates in their own embarrassment. You'll find that it is this type that calls upon their friends to tide them over until payday. Now who can turn down such an individual when the fact is known

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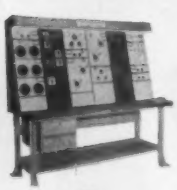

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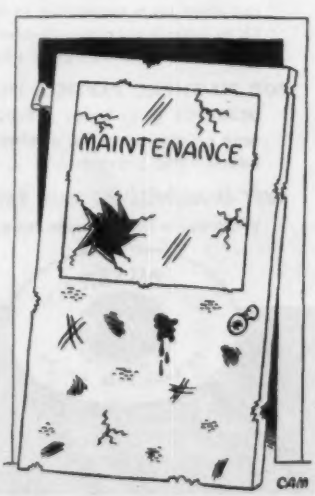
that he is so considerate of others when he himself is well-heeled?

I venture to say that the stability of a shop is dependent upon the economic stability of its members and it behooves the employer to do all he can to create this condition. There are some who will say "What the hell difference does the financial standing of the worker make to the welfare of the plant so long as the work is put out?" Need it be said that the economic stability of a worker contributes to his contentment and ability to function efficiently? There are workers who are very good at their jobs yet as far as finances are concerned, they are as little children —they cannot see any farther than their nose and repeatedly find themselves financially in the hole a couple of days before payday.

A foreman has enough grief on his hands without attempting to reform his workers. I wouldn't be surprised if a good number of the foremen find themselves in a tight spot a couple of days before payday, but for a certainty wouldn't avail themselves of Mills' ready cash. We are all prone to ignore the proffered wisdom of our elders and live it up, so to speak, with reckless abandon, thereby failing to create sufficient reserve to meet emergencies.

Could it be that Mills functions as a safety valve? If one member of the working force has the financial upper hand over one or more of his fellow workmen and is able to assist by lending a buck or two at whatever interest he deems safe to charge, that's his business and no foreman should burn out the linings of his conscience by worrying about it. If Mills chooses to charge ten percent interest for a loan for a period of



FROM DIESEL ENGINE TO ICE-CREAM FREEZER PARTS

AUTOMATIC BAR MACHINES

Handle All Types of Jobs

SIX AND FOUR-SPINDLE AUTOMATIC BAR MACHINES

GREENLEE Special Machine Tools

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Hydro-Borer Precision Boring Machines

✓ Efficiently...
✓ Economically

Greenlee design permits the handling of a wide variety of operations at various spindle positions ... makes it easier to split up long operations ... reduces idling time.

Threading, tapping and reaming can be performed in 3rd, 4th, 5th and 6th positions ... a special Greenlee advantage. Seven full-length T-slots on the main tool slide will accommodate the tools and attachments needed for a wide range of set-ups. Interchangeable cross-slide tooling and simplified cross-slide camming contribute to greater flexibility and faster set-ups.

Investigate! Ask any owner or operator ... they'll tell you that Greenlee is one of the most highly respected names in its field.

Write for Catalog No. A-405

GREENLEE BROS. & CO.

**1722 MASON AVE.
ROCKFORD, ILL.**

SHELDON Precision LATHES

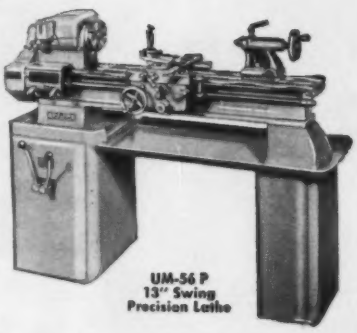
for the size Lathes You Need Most

Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13"... in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

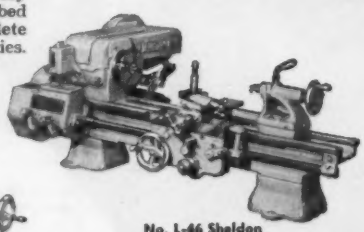
Powerful, all-V-belt, drive units—either the standard 8-speed (or 16-speed) E-drive; or the production favorite, a rapid, lever-shift U-drive. Where higher spindle speeds are desired, the standard E-drive can be built to provide speeds up to 2,000 r.p.m.

All Sheldon Lathes have handscraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of the accuracy tests actually performed on that lathe. (19 checks).

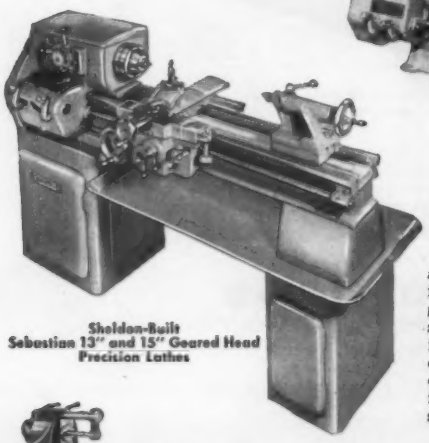
Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.



UM-56 P
13" Swing
Precision Lathe

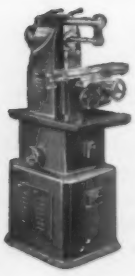


No. L-46 Sheldon
10" Precision Lathe



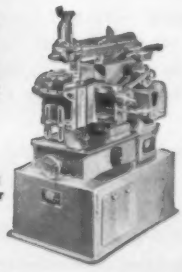
Sheldon-Built
Sebastian 13" and 15" Geared Head
Precision Lathes

The new Sheldon-built Sebastian Geared Head Lathes have greatly increased work capacity and many advanced features. These include a wide, heavy, hardened and ground bed . . . easy shifting spindle speed dial . . . 60-pitch gear box . . . independent drop lever apron clutches . . . cam-action tailstock clamp . . . and, automatic lubrication in the headstock and apron with "1-shot" lubrication of carriage.



SHELDON
Horizontal
Milling Machine

Send in coupon or write for catalogs and names of nearest Sheldon and Sebastian Distributors where you can see these new lathes in operation.



SHELDON
12" Shaper

SHELDON MACHINE CO., INC.
4234 North Knox Avenue, Chicago 41, Illinois

Gentlemen: Please send new catalogs describing:

☐ Sheldon ☐ 10", ☐ 11' ☐ 13" Lathes
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☐ Horizontal Milling Machine ☐ Name of Local Dealer
☐ Sheldon 12" Shaper ☐ Have representative Call

Name ..... Title .....

Company Name .....

Street Address ..... ☐ Company ☐ Home

City ..... State .....

SHELDON MACHINE CO., INC.
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one week why in hell doesn't the guy turn out three large brass balls when the boss isn't looking and go into business on North Main St?

The man with the hook is out for suckers and suckers he'll find anywhere, anytime, and anyhow. It is much better to have one man in a shop who is capable of conducting the emergency at a profit than to have everyone pestered by a strapee any hour of the day. Obviously Mills conducts his business on an unsound actuarial basis by requiring no security. This makes him liable to find himself on the short end in the event one of the borrowers fails to show up. It is on account of this liability that he sees fit to raise the ante to ten per cent a week.

You know what'll happen if you report the situation to Personnel, Al? The gink with the smooth bla-bla will get in touch with Mills and make a touch himself at odd periods. So, Al, you gray-hair producer, keep the skin on the end of your nose in a healthy condition by keeping it out of other people's business and attend to matters more deserving of your valuable time.

I can tell you in a few words what happened in a certain shop where such a buffer as Mills was not in evidence. There was a chap who liked his beer and invariably, a couple of days before payday, his thirst was unappeasable on account of his lack of funds. The favorite by-word among the worried workers was "Oh-oh! Here he comes, fellows!" If he couldn't make a touch with one he got sore and made the rounds and the unfortunate one who weakened found it necessary to argue hotly for his payment after the guy got his

"The apprentice boy wants to know why are there stones in peaches? It's about time the kid's father had a talk with him."

check. Now this all took up considerable of the company time. Were a Mills Loan Company in evidence this wouldn't be necessary.

No, Al, consider yourself in luck that you have a financial genius in your department who can relieve the stress of some of your men and at the same time eliminate the time-consuming practice usually accompanied by that disconcerting game of "lend-me-a-buck-till-payday."

Harrison Mitchell
Topeka, Kans

WHEN I WORKED in Boston as a machinist many years ago I had in the shop a fellow comrade that wanted to borrow 75 cents every Monday morning. I asked him why he needed that small amount of money; he said he used it to buy a piece of pie and a cup of coffee for lunch Monday through Friday. He spent every cent of his weekly pay over the weekend. I suggested that if he spent all his money except 75 cents, he wouldn't need to borrow money to get something to eat during the coming weekdays, but he wouldn't listen. Finally I refused to lend him the money thinking it was an unnecessary trouble every week, and I also wanted to give him a lesson. But then he got mad at me and went to another guy to get the money. In this case there was no interest involved, of course.

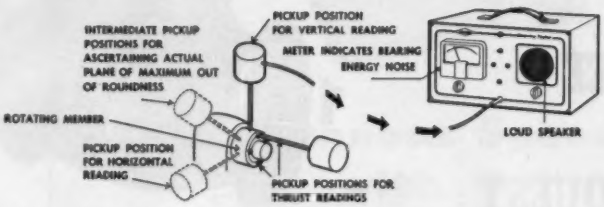
As to Mills, Al should talk to him in a friendly way and point out that his transactions are illegal. I wouldn't report this to Personnel; they cannot possibly know the details except what Al might tell them. So I think Al could handle this himself. If he couldn't get anywhere with Mills on the issue, he should drop the matter after he has told him his point of view.

Without mentioning this particular case, Al could take the initiative with management to give a lecture to the men on how to spend their money more wisely. This lecture could be given during the lunch hour, or a sheet of paper with the stenciled text could be enclosed in the guy's pay envelope.

I agree with Ed that sometimes one can do a fellow a favor by not helping him at all, but in this matter it seems that at least some young fellows would stop the borrowing habit if they get a reminder of it from above.

If Al is afraid Harrison would get mad if he heard about it he should

NEW
SPERRY BEARING TESTER
PINPOINTS
MACHINE WEAR AND
MISMATED PARTS!


INTERMEDIATE PICKUP POSITIONS FOR ASCERTAINING ACTUAL PLANE OF MAXIMUM OUT OF ROUNDNESS
PICKUP POSITION FOR VERTICAL READING
METER INDICATES BEARING ENERGY NOISE
ROTATING MEMBER
LOUD SPEAKER
PICKUP POSITION FOR HORIZONTAL READING
PICKUP POSITIONS FOR THRUST READINGS

Designed especially for shop use, the Bearing Tester detects the most minute wear in any rotating, sliding or moving part . . . assures precise, dynamic fitting of mating parts on the production line. It is an ideal "sentinel" for every type of plant maintenance and quality control program.

The Bearing Tester consists of a metal probe, or pickup, and a compact electronic amplifier. Any malfunctioning in the moving part under test is transmitted through the probe and shows itself both by a change in the noise level and the noise pattern visually presented on the tester's calibrated dial. It also registers through the tester's loudspeaker. Lightweight and easily portable, the Sperry Bearing Tester is a positive asset to preventive maintenance, quality control and receiving inspection.

The *Sperry Bearing Tester* story is given in our *Bulletin 61-105*, with text on its operation and information on testing interpretation. Write for your copy.

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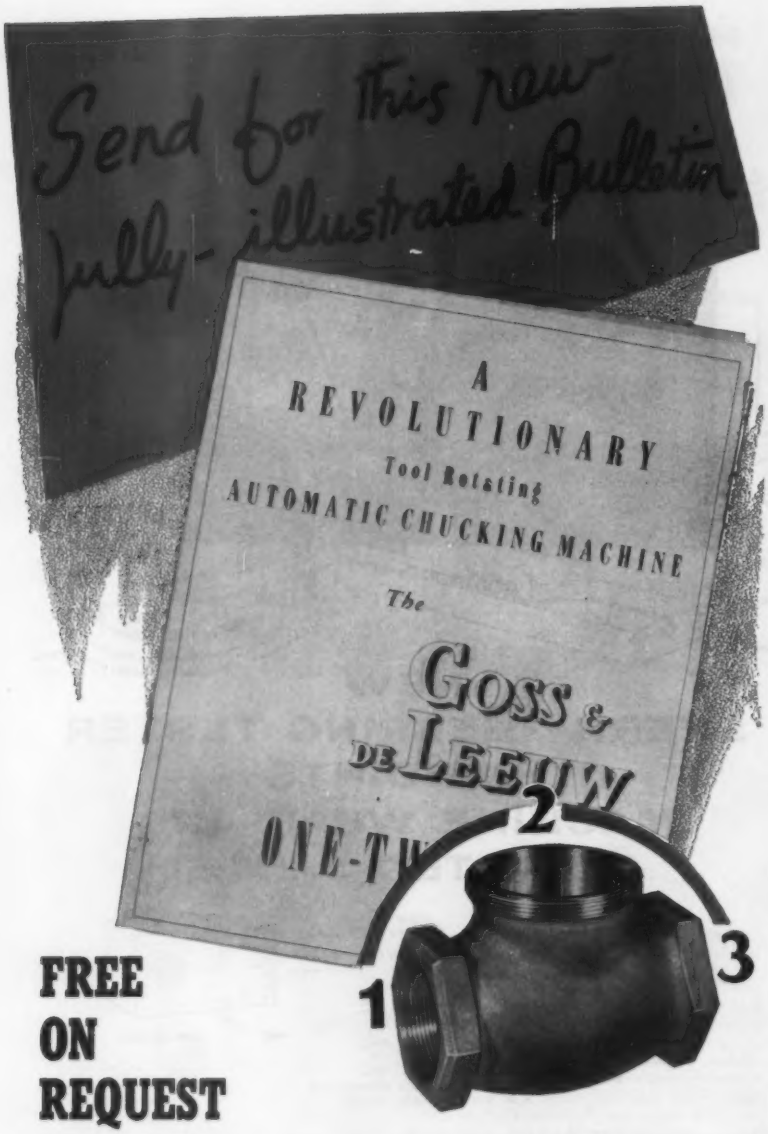
FIRST IN ULTRASONIC INSPECTION



FREE ON REQUEST

Here are the answers to most of your questions as to what "ONE-TWO-THREE" means in describing this outstanding development of Automatic Chucking Machines by Goss and De Leeuw. You'll be interested not only in the revolutionary design of the machine itself, but also in its extraordinary performance—and how it is possible to handle from one to three operations—in sequence or simultaneously—without changing set up.

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GOSS & DeLEEUW
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GOSS and DeLEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

ask him what to do in the case. I don't think Mills' offence is serious enough to warrant his discharge. If he is a good worker he might as well go right on and keep his job.

A E Fristedt
Stockholm-Bromma, Sweden

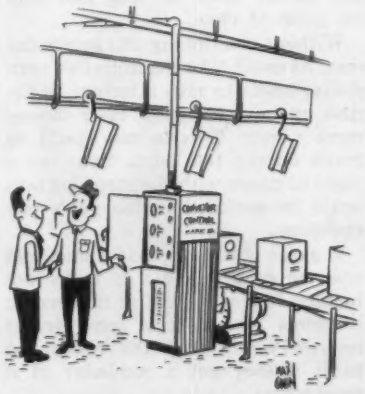
CERTAINLY Al is going on hearsay if only his pet busybodies told him about Mills lending money. Perhaps they would have liked to have been the one who was in Mills' position of being able to lend a few bucks.

True, the rate of interest quoted is rather high, but unless the company has a policy which states that the lending of money by company employees on company time is illegal, then Al has little to go on.

The suggestion made by Ed to stay out of the mess is good advice unless someone who borrows money from Mills complains about unfair practice.

It is difficult to see how anyone can get hurt providing Mills is presenting the fact that the interest is 10% per week. Surely any person who needs money that badly knows what it is costing him to get it. It is better perhaps, that Mills lends the money to these desperate individuals than to have them steal from some fund or person.

Any employee who borrows money from Mills at 10% per week interest cannot borrow from any other source. Perhaps they should not borrow. This is another point and is hardly one which a foreman should worry about unless he knows from first-hand information that the employee's family is being involved or the standing of the employee within



"It's so human it requires 1½ times more electricity when working overtime."

NEW *Synduction* MOTOR

Do you have an Application Requiring . . .

. . . Constant speed, regardless of load or voltage, depending only on frequency.

. . . Synchronized speed for a number of motors.

. . . Adjustable speed with minimum variation at any speed setting.

Synchronous Speed with Induction Simplicity

Allis-Chalmers new development — the *Synduction* motor — offers these characteristics at low cost — with the dependability of an induction motor. In addition to constant speed from no load to pull-out, it also offers across-the-line starting, wide range of speeds and high efficiency. It's another example of MORE motor pioneering by Allis-Chalmers.

Allis-Chalmers invites your inquiry, in the belief that many processes can be improved by the application of *Synduction* motors. Our engineers will gladly analyze your present operations to help you determine where *Synduction* motors can be applied profitably. Call your A-C office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin, for Bulletin 51B8440.

Synduction is an Allis-Chalmers trademark.

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Want PRECISION SHEARING at High Speed?

Check These Features and You'll Want a

DI-ACRO* POWERSHEAR

METALS

RUBBER — **PRECISION**—strips less than .025" wide accurately sheared, thousands of parts exactly duplicated.

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CHOICE OF MACHINE—two Vari-O-Speed models. Also two Standard Models running at set speeds.

PLASTIC — **MINIMUM OPERATOR FATIGUE**—especially designed for use where a high rate of production must be maintained.

LEATHER — **ENGINEERING SERVICE**—always at your disposal.

RUGGEDLY BUILT—backed by one year warranty.

SCREEN MESH — **DELIVERY**—immediate on most models.

COST—that's good too.

*pronounced Die-ack-ro.

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Gives full details on both hand and power operated Di-Acro Shears, Benders, Brakes, Rod Parters, Notchers, Rollers and Punch Presses.

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di-acro PRECISION METALWORKING MACHINES

the community (which reflects on the company) is being degraded. Only under these conditions, if no company policy is established, should a foreman try to interfere with the personal lending of money. Better that the lending be open and above board in the company than on the sly when and where someone might get hurt.

Of course the best solution is to have the company establish a credit union where funds can be obtained without embarrassment and at a legal and low rate of interest. Such plans have been very successful in many plants. Perhaps if Al wants to stop the loan shark he can talk management into this idea.

Charles D Townsend
West Hartford, Conn

BOW AND SCRAPE, OR STAND AND FIGHT

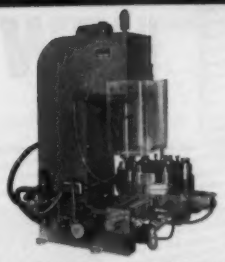
Should a foreman be willing to take orders from Engineering on such things as machining a new material? Or should he insist on full authority in his own department with consequent responsibility if something goes wrong?

WITH MACHINABILITY data at their fingertips, engineers can reach out in a number of directions to save time, trouble, and cost in the machining of new material in the shop. With the technical data available in Engineering on feeds and speeds on new aluminum-alloy rings the shop has to machine, the foreman would indeed be derelict in his duty to refuse such invaluable advice. The en-

"I'm awake, if that's what you're wondering."

AIR-HYDRAULICS INCORPORATED

INCREASE PRODUCTION 50%



IT'S BEEN DONE—for a "big 3" auto company. Tooling shown increased production on press assembly of steering knuckles from 1200 to 1800 pieces per hour—with added operator safety. **COMPLETE SET-UP**—#1405 Air Index Table, #C-300 5½ Ton Press, controls and fixtures were furnished by Air-Hydraulics, Inc. An electrical circuit synchronizes press and table for fully automatic operation on standard line pressures. Operator places pieces on fixture outside guard • Parts are indexed into position and pressed together • Assembly is removed automatically and chuted into container. Constant pressure throughout ram stroke has eliminated previous trouble caused by variations in stock thickness and other factors.

AIR-HYDRAULICS INCORPORATED

"EXPLODED AIR" IMPACT HAMMER

MORE STROKES / CU. FT. AIR / MINUTE

NO FOOLIN', when operated at 100 psi line pressure the Model Z-2, 12,000 lb. hammer illustrated will make 50 strokes per cubic foot of air. That's at a rate of 60 per minute on manual control or upwards of 120 on automatic. The Model Z-6, 40,000 lb. capacity hammer will punch out 15 strokes per cubic foot at the same rates.

EASILY ADJUSTABLE to any pressure within capacity, impact is then constant at any point in the stroke. Variations in stock thickness or improper positioning are handled without damage to work, dies or hammer.

FOR THOSE AWKWARD JOBS, from forming to forging, the head of the Z-2 may be purchased separately and mounted at any angle, even upside down.

AIR-HYDRAULICS INCORPORATED

202 BELDEN ROAD
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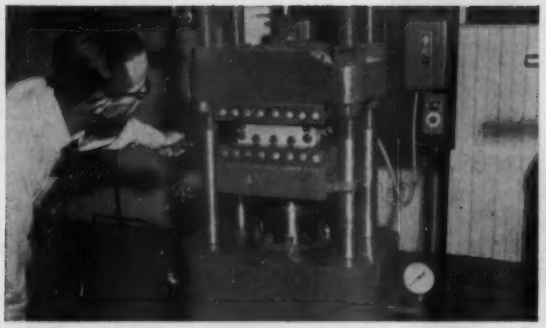
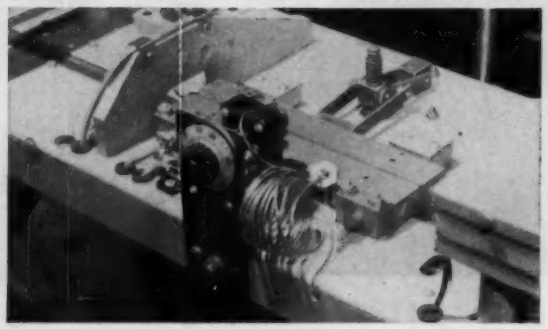
CHROMALOX Electric Cartridge Heaters

. . . compact, self-contained heat for your production equipment

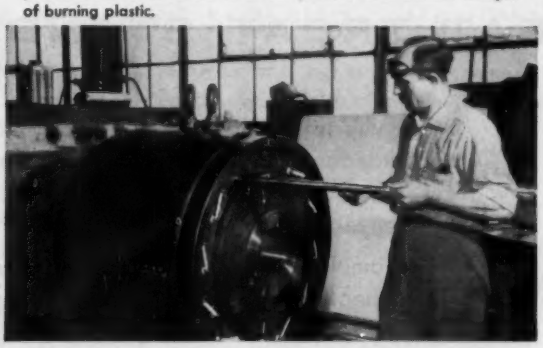


Plastics molding press—Thermostat accurately measures out the exact temperatures needed in one press or a dozen—a different heat for every press if necessary.



Packaging machine—Controlled heat in each of two platens tightly seals food product in plastic bags. Thermostatic control provides 160°F maximum heat for positive seal without danger of burning plastic.

Die-forming—Uniform temperatures of 900°F maintained in both top and bottom halves of die to lessen mechanical stress during forming of camber sheet for aircraft propeller.



Extrusion press—Easily installed heaters keep billets at 1000°F to provide proper flow . . . provide uniform temperature; constant, accurate control; rapid heat-up with minimum radiation loss.

When you install Chromalox Electric Cartridge Heaters, you get the many advantages that only electric heat can provide. Low initial cost; quick and easy installation; long, maintenance-free heater life. Instant heat-up. Accurately maintained temperatures to 1000°F controlled at each machine. No pipes, valves or flues. No flames or fumes. Cool working area.

There is a Chromalox Electric Cartridge Heater for every spot heating job. Lengths to 40 inches; diameters of ⅜ inch to 3½ inches. Ratings from 30 to 8750 watts, with terminal and lead wire styles for every type connection and application.

For the full story, call your Chromalox Representative, or, write today for Bulletin 850.

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Special Protective Features Give You Long Heater Life

FLEXING

Spring strain reliever for applications in which heater leads flex. High tensile spring, mechanically locked to heater, covers lead wires a distance sufficient to distribute stress.

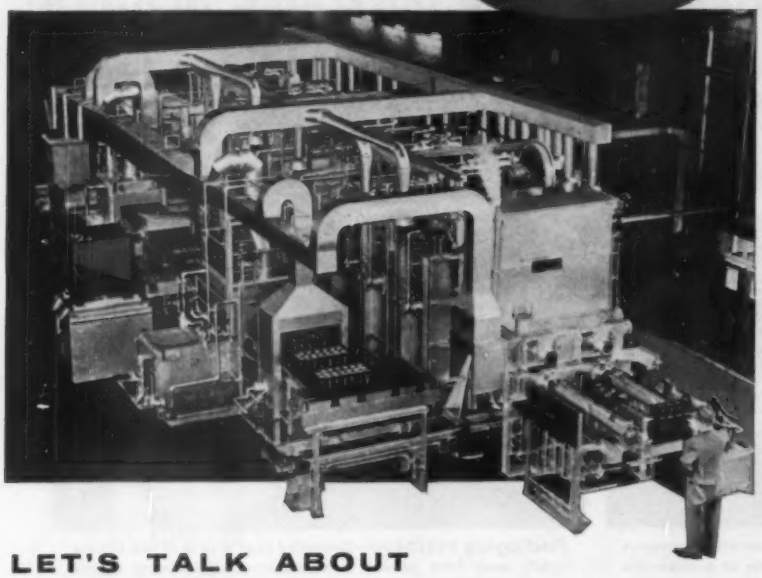
ABRASION

Flexible brass conduit protects lead wires against abrasion from other moving parts and from accidental mechanical damage. Safety factor where lead wires are exposed to machine operator.

MOISTURE

Moisture-resistant flexible brass conduit protects lead wires of heaters operating in presence of steam, water, oil and vapors. Added protection from flexing, vibration and mechanical damage.

BLAZING THE HEAT TREAT TRAIL WITH HOLCROFT



LET'S TALK ABOUT

HEAT TREAT STANDARDS

When you take a long look at today's heat treat standards, you'll find that many of them were originated or perfected by Holcroft and Company.

For example, back in 1922 the removable electric heating element was developed. As far back as 1934, Holcroft recognized the significance and importance of equilibrium constants and their value to controlled atmosphere heat treating. And in 1945, was initiated the use of refractories and ceramics in place of scarce and expensive nickel-chrome alloys in vital parts of the furnace. These are only three of many, many innovations which have become heat treat standards in the industry.

Pioneering in the past—forward thinking for the future . . . that's what you get when you invest in a Holcroft heat treat installation. And that investment is returned in the form of higher quality control standards and lower heat treat costs. Better investigate—today!

HOLCROFT AND COMPANY

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PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

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CANADA: Walker Metal Products, Ltd., Windsor, Ontario

gineer knows optimum machining rates, and has data on the new alloy from the mills. Why then shouldn't the foreman take his proffered recommendations instead of standing on ceremony and harboring the mistaken idea of loss of authority if the work isn't done his way?

The foreman can move toward maximum performance with the new alloy by following Engineering recommendations based on specific technical data rather than cautiously applying his own untried machinability experimentation and hoping for the best. It's clearly to the advantage of the foreman to do the machining job the scientific, Engineering way instead of wanting full authority to do it his own trial-and-error way. And what's wrong with taking advice from the slide-rule department on feeds and speeds?

There's no need for the shop foreman to bow and scrape, or stand and fight with the engineer. If he's a reasonable man, the foreman will weigh all the facts and arrive at the right decision—in this case, acceptance of Engineering recommendations on the best cutting speed and feed of the new alloy. How unreasonable can the foreman be—the new alloy is admittedly tricky to machine; the shop hasn't had any experience with it; Engineering does have data from the mill. Why shouldn't the foreman get off his high horse of authority and be reasonable? It's well to remember that reasonable men always agree if they understand what they are talking about. It has been demonstrated that the degree of one's emotion varies inversely with one's knowledge of

"Come on, now—150 tons of steel just doesn't get up an' walk away! Where did you put it?"

THEY'RE BOTH TWO DIAMETER DRILLS . . .

BUT WHICH ONE SHOULD YOU USE?

STEP TOOLS VS. SUBLANDS

Manufacturing Accuracy:

Subland tools are turned, machined, ground and faced—all operations between centers for ultimate accuracy. Step tools are chucked in single collet and ground to approximate desired size.

Maintenance:

Sublands tools incorporate separate lands for each diameter—thus they can be accurately resharpened many times. Step tools must be reamed during sharpening procedure—losing concentricity and continually weakening tool.

Performance:

Subland tools are built right to work right. They perform their precision operations fast-easily because they are accurately developed. They cost slightly more than standard tools—but they outlast them many times.

Results:

Tool test reports prove conclusively that Sublands out-perform standard or step type tools on practically all continuous, multiple drilling operations.

Versatility:

Subland tools can be made to accurately and dependably perform any practical number of operations—simultaneously, sequentially, they are for themselves in time, tools and equipment.

A MOHAWK SUBLAND . . . *NATURALLY!*

Mohawk Subland Drills are the modern answer toward faster, more accurate, economical combination tooling operations plus amazing production saving.

Why stock heavy inventory of widely varied step type tools for consecutive drilling operations? One pass with a Mohawk Subland Drill will do the work of two, three, four—or more—*ordinary* drills because Sublands last longer . . . stay accurate through multiple regrinds . . . and reduce hole costs.

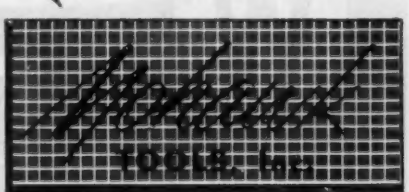
A Mohawk Subland is the one versatile tool that will quickly pay for itself in man hours, equipment and tool dollars. They're immediately available in an amazing range of "Off-the-Shelf" Size-Optional sizes and types for every conceivable drilling combination. Highly specialized types are also readily available.

Write . . . Wire . . . Phone . . .

today for your Mohawk Subland Tool Catalog and/or the new brochure on Sublands vs. Step Tool operations. They're yours for the asking . . . and if you are interested in combination drilling operations, you'll find dozens of ways to save your equipment dollars.

NORMAL DELIVERY ON MOHAWK SIZE-OPTIONAL SUBLANDS—ONE WEEK FROM RECEIPT OF ORDER!

world's largest producers of Sublands



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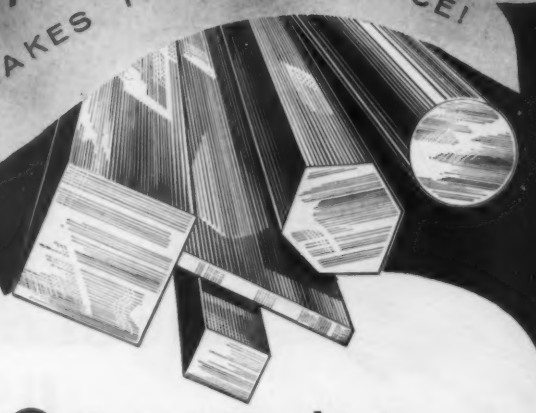
Controlled Quality
MAKES THE DIFFERENCE!



① Faster Machining
② Longer Tool Life
③ Finer Finish

WITH

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LEADED STEELS

AND

SCREW STOCKS

Complete range of analyses in quality-controlled free-machining LEADED STEELS and SCREW STOCKS to your specifications

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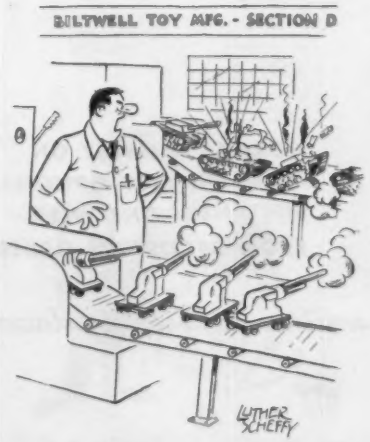
the facts—the less you know the hotter you get.

From my experience in the engineering field, I have found considerable unwillingness on the part of many production foremen to accept beneficial production recommendations from the engineering departments of their plants. Ostensibly the foremen labored under the misapprehension that acceptance of such recommendations was tantamount to taking orders from Engineering and infringement of their authority and prerogatives as shop foremen. These foremen failed to understand that the engineer was there to serve them. That the wealth of technical data, and current special information in the engineering department was not for Engineering use exclusively.

Engineered production is the most efficient because it combines progressive engineering with skilled shop production. Engineering data that covers the optimum speed and feed for cutting a given material will determine the type of machine tools to use, with enormous cost-savings potential. This knowledge should be used to the fullest extent in the machinability programs in the shop. If high cost operation is to be avoided, the foreman's experimentation with his ideas on machinability should be avoided and the engineer's advice accepted. The foreman who questions the engineer's knowledge of production and manufacture should consider the fact that where technical data is available to do the job, it should be welcomed to the point of setting up close liaison between Engineering and Manufacturing.

One basic idea must be clear to

(Continued on page 224)



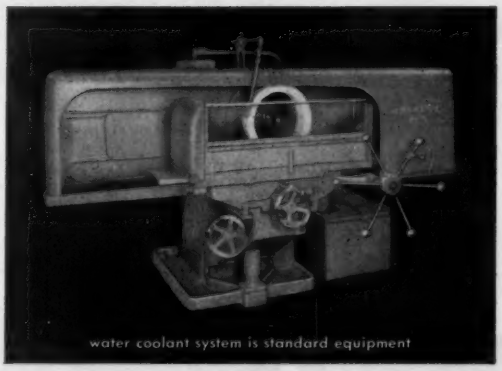
"All right! Which one of you started it?"

NEW IDEA!

why MACHINE it off—when you can GRIND it?

Stock really comes off with an Abrasive 18″ Face Grinder. Sixty-five thousandths of an inch at a pass! A rugged 15 H.P. motorized Abrasive spindle turns the wheel at 900 R.P.M. Surface speed is 4500 feet per minute. 24″ table travel, plus 18″ wheel gives big work capacity.

Time is money! Machining flat surfaces wastes both! Grind it off faster, with better surface finishes, with an Abrasive 18″ Face Grinder just as leading metalworking plants—those really making money — are grinding forgings, castings and dies.



water coolant system is standard equipment

TYPICAL APPLICATIONS ■ Castings . . . eliminates milling or planing . . . requires less stock to be left on for finishing . . . as much as 3/16″ of stock can be saved on each surface. ■ Automobile Body Dies. ■ Plastics Molding Dies. ■ Molded Insulating Fire Brick. ■ Ceramic Insulators. ■ All types of Forging Dies. ■ WHEREVER FLAT, SQUARE SURFACES ARE REQUIRED.

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MACHINE TOOL COMPANY
EAST PROVIDENCE, RHODE ISLAND

The Big Trend in Metalworking...

MOVE the metal ...it's cheaper than

HOW NEW METHODS SAVE BIG SUMS

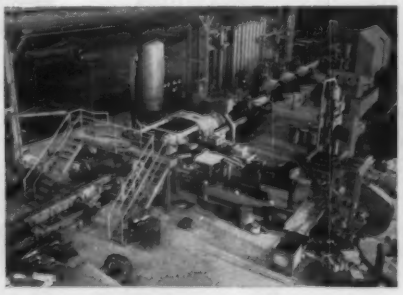
A. Parts are produced primarily by forcing metal into the desired shape rather than by "removing" or "machining" it. It is far faster... saves tremendously in time and labor.

B. The amount of metal in the initial slug, shot, billet, sheet, etc., is only slightly more than the total amount in the finished piece. Thus scrap and machining are held to an absolute minimum.

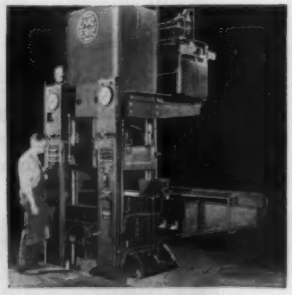
Metalworking plants casting about for ways to reduce production costs are turning more and more to the newer methods of forging, drawing and extruding in which metal is being "pushed around" rather than "removed." These processes basically are the hot extrusion of alloy steel, cold "pressure" forging of aluminum, cold extrusion of steel, and high pressure closed die extruding of aluminum and other non-ferrous alloys. Also falling within this category

Closed die extruding of heated aluminum reduced production time 99%.

Cold steel extrusion reduced scrap 43%



Hot alloy steel extrusion is now an established art.



Metal powder parts are often produced with no machining.

● *New and improved production techniques save millions...arouse widespread interest*

1. Actual parts production is cut from hours in typical cases to minutes or even seconds.
2. Pieces generally have superior finish and improved physicals including grain structure.
3. Tolerances and uniformity equal or better those of older methods.
4. Scrap is greatly reduced and in many cases practically eliminated.
5. Unit costs go way down.

REMOVING it!

are somewhat older though greatly changed and improved methods for the extrusion of aluminum, hot forging of ferrous metals, powder metallurgy, deep drawing of sheet and die casting. The most recent developments involve variations and combinations of the above applied to many products and materials. Our engineers are in close daily contact with these developments. They'll be glad to help apply any of them to your production. Call or write us.

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HYDRAULIC PRESSES

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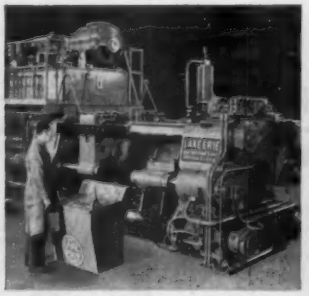
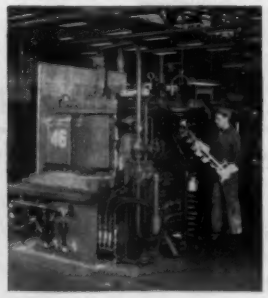
EXTRUSION PRESSES

New developments in steel forging have greatly expanded its application.



Non-ferrous extrusion installations now embrace titanium, magnesium and newer metals.



Production rates of die cast aluminum and zinc parts have been upped 20% to 30%.

● *"MOVE the METAL" is NOT NEW...*

When this advertisement first appeared several years ago, it apparently sparked the current recognition of the "Move Metal" idea. Today the practice is widely accepted, acclaimed and growing. As the leader in the movement, Lake Erie will gladly share its experience with you.

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You'll get quick action on your order for alloy steel bars, billets or forgings . . . no matter what size, shape or heat treatment you require . . . when you call any one of our seven warehouses.

All seven are conveniently located in principal industrial areas. Each is staffed by expert metallurgists, and is well-stocked to give you speedy service.

Fill your current needs by ordering our own HY-TEN steels, the "standard steels of tomorrow", or standard AISI or SAE grades.

Or write today to our Cambridge office for your *free* Wheelock, Lovejoy Data Sheets. They contain complete technical information on grades, applications, physical properties, tests, heat treating, etc.

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HOME OFFICE:
WHEELOCK, LOVEJOY & COMPANY, INC.
137 Sidney Street, Cambridge 39 Massachusetts

the foreman—that the work and recommendations of the engineer are aimed to serve him. It's not a question of authority or responsibility, of who has the say, or who takes the blame. It's a question of achieving certain desired results. In this case, the desired results are optimum machinability of the new alloy.

Manufacturing executives who want to cut costs, save time, reduce the need for facilities, make a better product at lower cost, know they can depend on the technical aid of the engineer. But for the die-hard who is afraid of loss of authority and responsibility if he accepts such advice, the engineer's philosophy in dealing with this type of individual should be this: an obvious difference of opinion about a problem can be resolved to everyone's advantage if all the facts are known and clearly presented.

It would no longer be a question of who gets the authority and who takes the responsibility. If all the facts are laid on the table, and reasonable men weigh them, few disputes would ever arise, and the facts would liquidate the arguments.

Harry Kaufman
Philadelphia, Penna

RETIREMENT TRADE

Would a retirement pool, in which a number of companies participated be practical? Then a worker who changed jobs, or was fired, could still be eligible for his retirement rights.

In general, pensions were originally initiated for worthy motives, their main purpose being to aid and assist the employees in accumulating funds for their latter years when

"This place is becoming one big happy family—his!"

they could no longer earn a livelihood. In spite of a weak beginning they grew and became more and more extensive as time went by. This growth was not based on the noble motives of the originators, but resulted from later discoveries.

The pension has in many cases become a ball and chain on the employee. Under most pension plans the amount contributed by the employer is untouchable by the employee unless he remains with the company until the retirement age. Companies advertise and boast of the size of the pension fund. Where did this money come from? From the only source of company funds, namely, the earnings of the employees. All funds are earned by the employees as a result of their efforts. The company withholds these funds, uses them as a weapon against the employees and does it under the guide of employee aid.

When an employee in such a company asks for a raise he is told that the pay scale may be below that in other companies doing equivalent work but the difference is made up by the company's contribution to the pension fund. Once a man has spent five or ten years in such a company they know that they have a good grip on him and that he will stay on even though the pay may be better in other organizations. They know full well that the man does not want to leave because he does not want to lose the pension.

It would be a wonderful arrangement if the pension plans were set up so they could be carried over from one company to another. If a man did not receive a just and equitable wage he could always change jobs without the heavy penalty of a lost pension. He could meet his employer on a just and competitive basis.

Employers will fight any move to weaken this, their most effective grip on the employees. Under this transfer arrangement the company would be forced to meet the bids of other companies for the services of these employees. With the pension plan the competition for employees only applies to younger, inexperienced men. This is the main reason why the wage scale for the younger inexperienced employees has increased more rapidly than that of the older, mature employees. The plan of operation is to pay as much as necessary to get the man and to give raises during the first few years of service. Then instead of continuing to provide fair and equitable increases in pay to match the growth of his experience, part of the money

Draw a 300-mile circle around your plant —

You're almost certain to circle one of Milford's five manufacturing plants!

There's hardly a metalworking plant in the country that isn't within overnight trucking distance of one of Milford's five manufacturing plants. And 20 sales offices add to the convenience of ordering and *getting* rivets when you need them NOW!

To improve product appearance and strength
. . . to take full advantage of automatic assembly
. . . to cut delivery time and production costs
—get in touch with Milford first!

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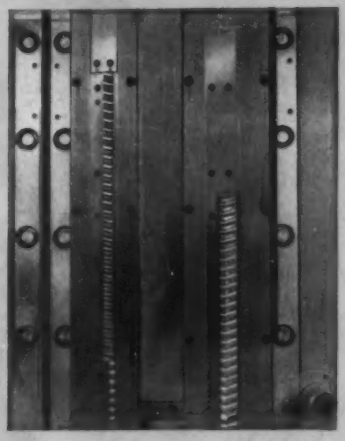
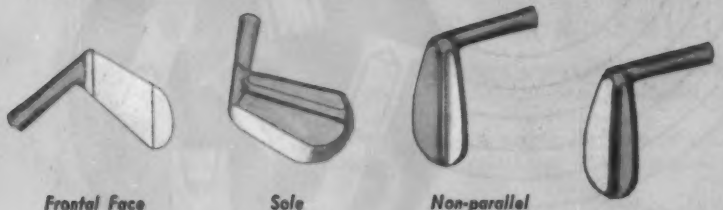
Here's how A. G. SPALDING & BROS.

uses those good

LAPOINTE -BROACHES

to "up" their quality and slash production costs





Frontal Face *Sole* *Non-parallel cuts on back*

The fine finish you see on the surfaces of Spalding irons, No. 2 through No. 9, didn't get there just by chance! (*Fine finish is inevitable when using Lapointe-Broaches.*) **The perfect accuracy** of the machined surfaces, so necessary for obtaining the required balance and "feel" in matched sets, wasn't an accident either! (*Lapointe-Broaches are designed by capable engineers and ground by experienced craftsmen, so the accuracy of the broach is assured from the start.*) **The production economy** resulting from mass-precision Lapointe-Broaching was a real bonus on the deal . . . and particularly desirable in these times of rapidly rising shop costs.

We invite you to consider using *good broaches,* LAPOINTE-BROACHES, to drive down production costs.

LAPOINTE-BROACHES, *Electrolized* increase broach life between grinds from 2 to 10 times.

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THE LAPOINTE MACHINE TOOL CO.
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THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

LAPOINTE
known to be the best in
BROACHING

due him is held back making the ball and chain heavier as time goes by. A man in such a trap looks out at employment opportunities with the same hopeless longing as an incarcerated criminal looking at the patch of the outside world which is framed by the bars of his window.

A system of transfers of pensions would be complex and impractical in general because of the great variation in pension plans. The real answer lies in pension plans where the employee receives a just, lump-sum payment when he leaves the company.

Sing Yen
Brooklyn, NY

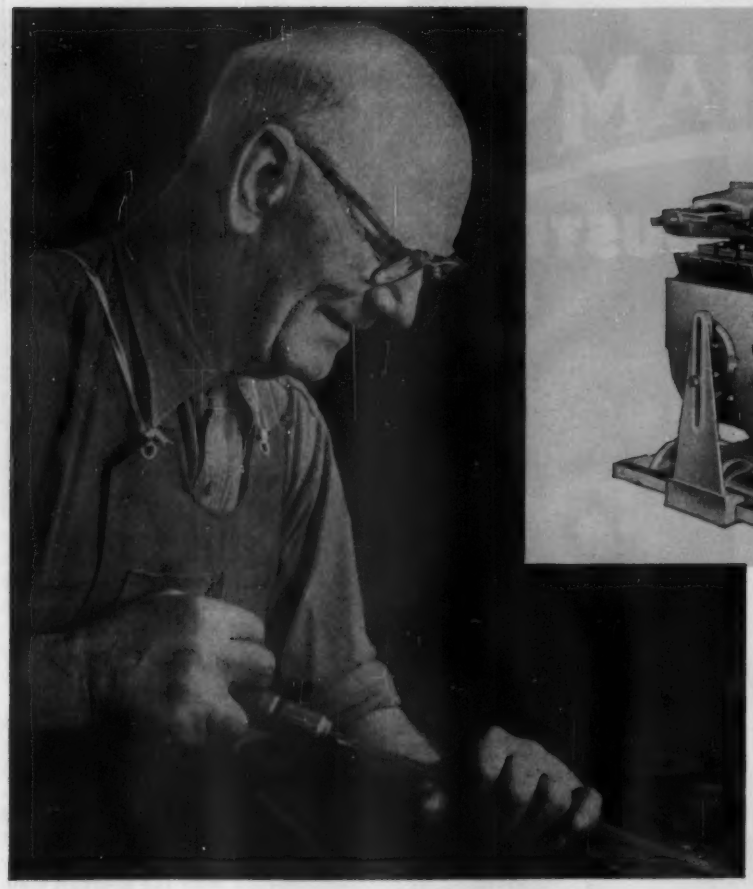
EXECUTIVE FOREMAN

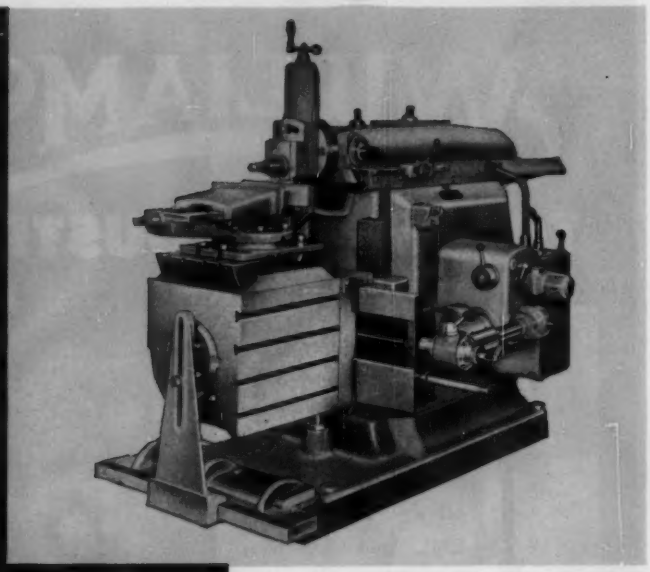
How "executive" should a foreman be? Where is the line between availability and leadership? If he makes himself always available for questions and worker-guidance is he down-grading his own position?

THERE are men with a streak of childish vanity in their natures who go out of their way to get talking to the chief. To be seen talking to the foreman is meat and drink to them. Any topic will serve the purpose, any foolish question will do as an excuse to knock on the office door or to waylay the foreman in the shop. Such men should be gently but firmly discouraged at all times. Every foreman should know his men, the talkers from the doers. When he knows that, the rest is easy.

No high-grade foreman wastes his

"There, there, besides everything, what's wrong in your department?"





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VMA Model ES Heavy Duty Shapers, available in Plain and Universal Models and with 18", 22", 26", and 28" stroke, feature:

- Wide selection of ram speeds and power feeds
- Automatic forced lubrication system
- Horizontal power rapid traverse of table through independent motor
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- Anti-friction bearings throughout
- Dependable safety clutch

VMA Model EV Series... economical standard-duty Shapers with stroke lengths from 14" to 24".

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the opening of the Texas oil fields

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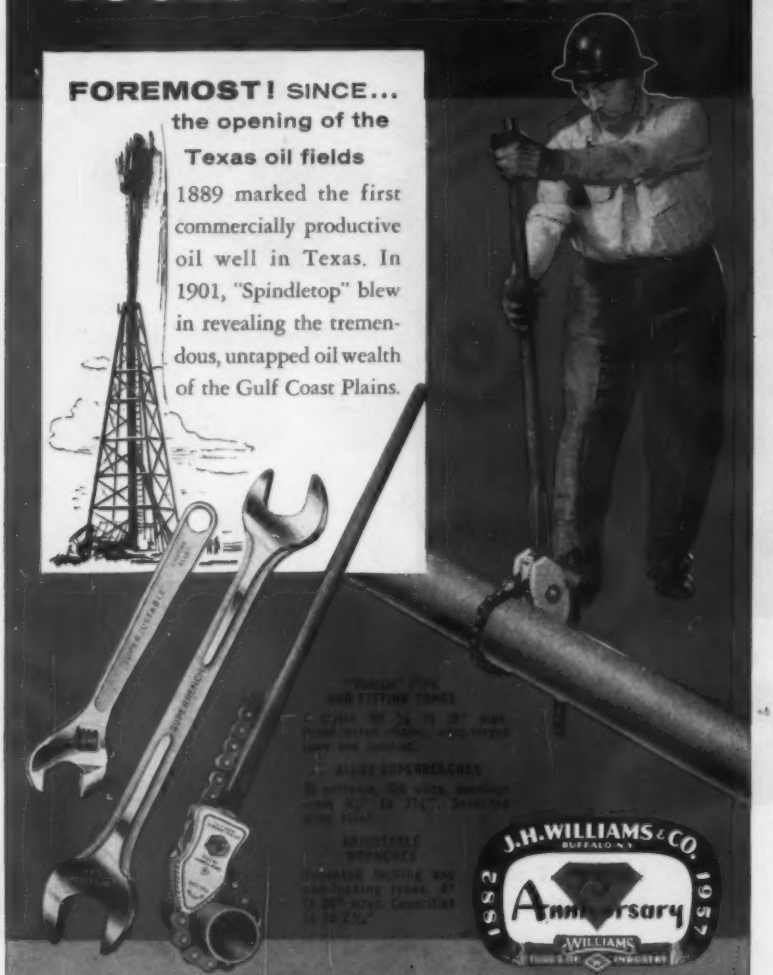

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NOTE: You get the quickest delivery at lowest cost from your local distributor.

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time listening to senseless gossip or idle questions. We all get it, and my approach to the unimportant query is to ask the offender "Have you had your charge hand's opinion on this matter?" That procedure noticeably diminishes their thirst for engaging me in conversation. Moderation in all things is a social grace and responsible executives should school themselves in the art. They should neither make themselves available to the men for minor advice nor should they plainly show their displeasure at being needlessly buttonholed.

The simple and effective way is to make clear to the men that the charge hand is their immediate boss and that he must be consulted first. If he does not know the answer, he gets it from his boss and feeds it back to the man. That is the rule of the road to good management. It is constructive, it educates the foolish among the men, it gives the charge hand status and leaves the foreman free for more important, more lucrative work. At the same time the foreman should not be completely aloof from the men.

No matter how "executive" he may be or how busy, he must always make time to be much in evidence on the shop floor, taking a keen interest in the discipline, and the methods employed by the several men in the execution of their various jobs. A word with the foreman, now and then, is always appreciated by the men and those little courtesy calls should be made on different men at different times. In short, they should be staggered. There must be

"You're new here, Harshaw! . . . You'll learn that 'working like th' Devil' is merely a way of life, here!"

300 ton Pacific Hydraulic Brake is accurate within thousandths of an inch. Angles from top down are 90°, 116°, 100°, 120°, 166°.

Presetting controls for the different angles to be formed consecutively.

forms 7 different angles in succession without resetting controls

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In a single handling of metal, Pacific Hydraulic Press Brake forms an entire series of different bends. You set the controls just once and run through the entire sheet or plate. Handling time is cut to a minimum. Operating on the "air bending" principle, the ram comes down to a different depth with each stroke forming the various angles preset on the controls. Each bend is accurate within thousandths of an inch. The length of stroke can be adjusted to match any job; bends up to 12" deep can be formed in a single stroke while the stroke can be reduced to less than 1/8" and the press will cycle 50 strokes per minute or more.

The ram is held level automatically by patented controls so that work can be done at any point along the entire length of bed. Thus a piece can be passed progressively from die to die for blanking, deep drawing, embossing, punching and forming. In punching, continuous power drives the punch through heavy plate with the shock being absorbed by the hydraulic cushioning of the cylinders. This Pacific Hydraulic Brake is also used for straightening, rubber pad forming, pipe making, stretching, extruding, hot forming and even shearing heavy plates. The Pacific cannot be jammed or overloaded and its precise accuracy is maintained indefinitely. Maintenance is low.

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CITY

STATE

no coteries—the foreman must spread himself around. During those informal chats, some man is sure to ask the foreman's advice on some aspect of the job in operation. That is the red light for the boss and my reply generally is "I think so and so would be the right thing to do, but just to make sure, have a word with Mr X before deciding." I then move off, leaving him to see his charge hand who will give the necessary guidance.

Ed looks like going all high hat when he says "The only time I work is when something really wrong pops up." That's locking the stable door when the horse is stolen, with a vengeance. If Ed has group leaders or charge hands to look after detail administration, *he* should be working full time to insure that nothing really wrong pops up. Only in that way can he lead, support and inspire his assistants. In virtue of his higher status, he is in a position to survey the whole field of operations, to anticipate the fences which the group leaders may miss because of their preoccupation with lesser things we call details.

Ed's advice to Al to make full use of his group leaders is good, good for shop discipline and good training for the group leaders, with a view to accustoming them to responsibility and with a view to spotting possible future foremen. His advice to Al to bypass his group leaders when something big is involved is bad in any sense. Big or little, the chief should not discuss any matter with the men over the head of their immediate boss, the group leader.

No, Ed is not taking his executive idea too far, he is not taking it far enough. He has lost his executive sense when he proposes to examine the men's complaints, suggestions, or queries at first hand, instead of via the group leaders. Ed is a small man eager to play a big part but with no clear idea of how to go about it; he lacks vision and imagination.

Provided an executive foreman is keenly aware of all that sound administrative practice implies, he will not lose control of his men. In its truest sense, it means management by example, handling others as you would have others handle you were the positions reversed. It means being scrupulously fair and reasonably tolerant and making sure that all are heard, provided use is made of the proper procedure. Insuring that is a full-time job that comes naturally to some few and can be cultivated by many.

C Donald
Lanarkshire, Scotland

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has developed from more than 90 years' specialization with practical metrology. The resulting SIP techniques—as used in length measurements by national Bureaus of Standards—may be most profitably applied with SIP UNIVERSAL & LINEAR MEASURING MACHINES, SIP high precision MICRO-INDICATORS, and SIP PROFILE PROJECTORS. How well these techniques and machines can work to your advantage is illustrated in the film offered below.

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Please arrange, with no obligation, for a free group showing at my plant of your 25 minute, 16mm. sound film, "Absolute Measurements."

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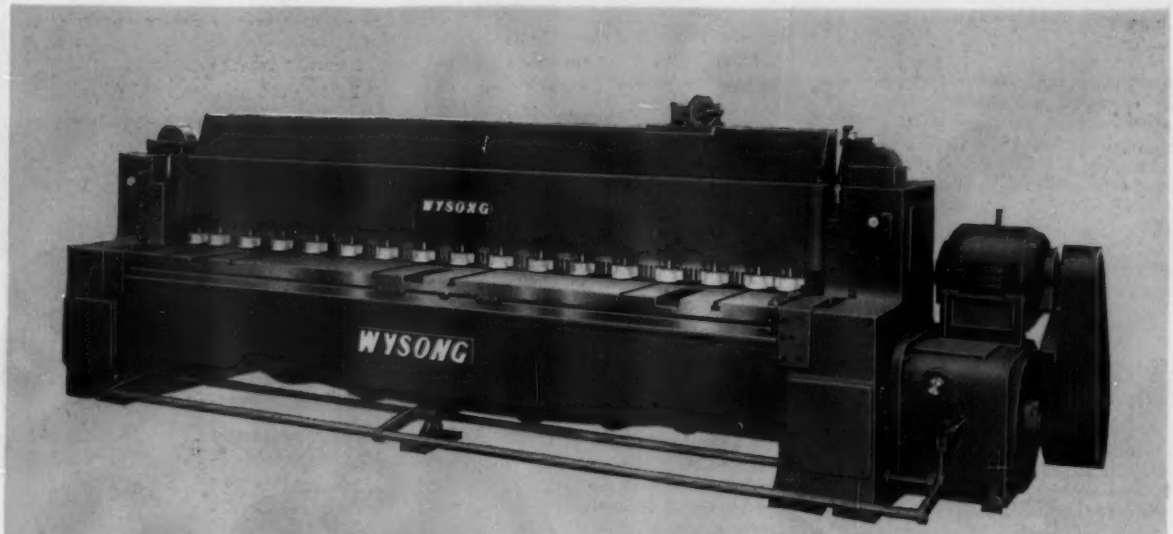


Wysong No. 1225, capacity ¼" mild steel, cutting length 12 feet.

Wysong Squaring Shears are

RUGGED to resist shock and pounding

RIGID to maintain accurate alignment

The primary function of Wysong Shears is to give you maximum production with unsurpassed accuracy — day after day, month after month. Their massive hi-tensile castings assure greater resistance to deflection. Their extra large, accurately machined bearing surfaces prevent twists and binds.

Holddowns provide all the power needed for positive clamping of stock — yet, are easily adjusted to prevent marring soft metals or polished sheets.

Ball-bearing, precision back gauges are designed and built to withstand the impact of volume shearing. Easily adjusted to compensate for eventual wear.

Automatic lubrication is standard on larger models — one-shot lubrication on smaller models.

Safety features include totally enclosed clutch and gears, adjustable stationary finger guards, non-repeat unit and treadle lock.

Simplicity of operation and superior design are keys to low maintenance and low down time.

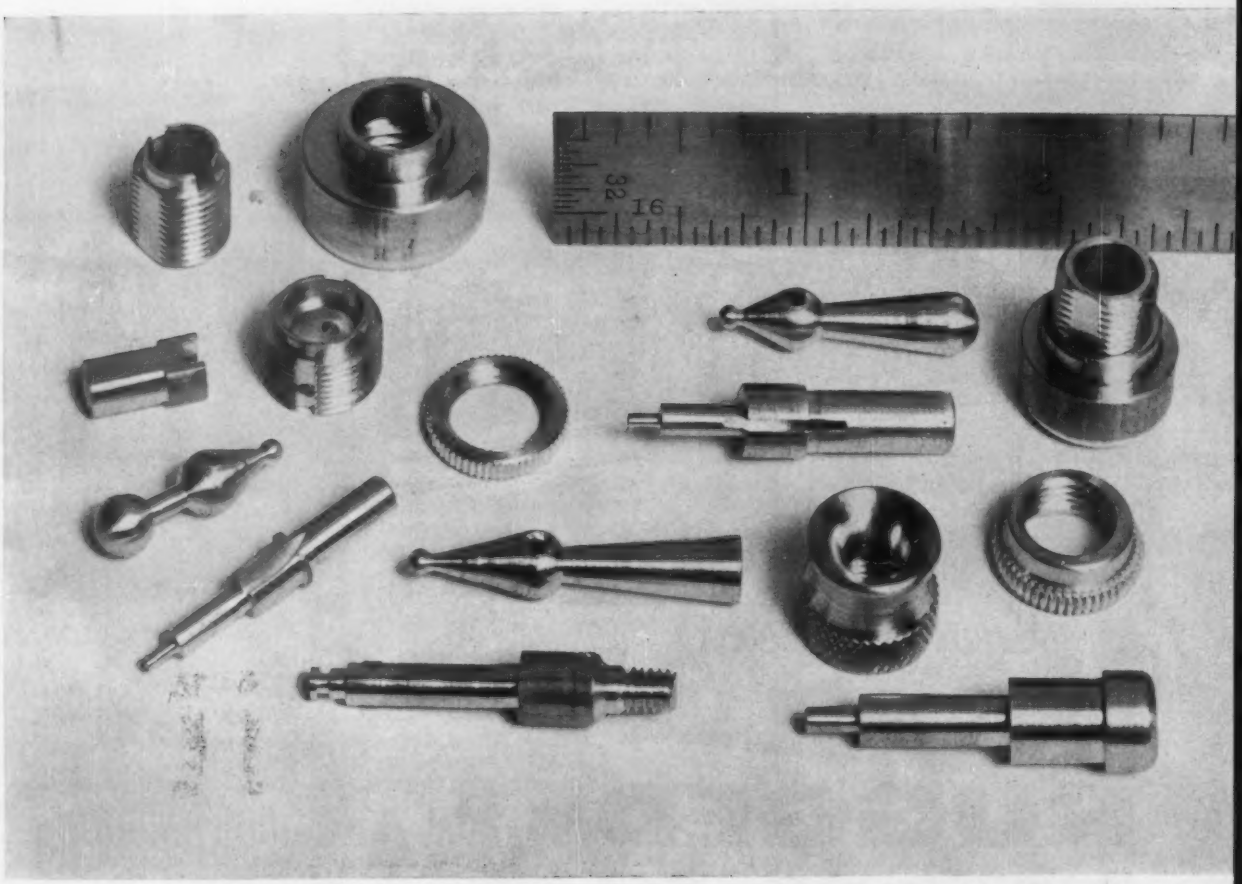
Power models are available with cutting lengths from 48 inches through 12 feet — capacities from 16 gauge through ⅜" mild steel.

For greater accuracy, larger volume, easier operation and the finest in design — Buy a WYSONG . . . It's MILES Ahead!

Buy A Wysong ... It's Miles Ahead

WYSONG

Wysong and Miles Company
Greensboro, N. C.



Typical parts machined by Leviton Manufacturing Company from Alcoa Aluminum Screw Machine Stock

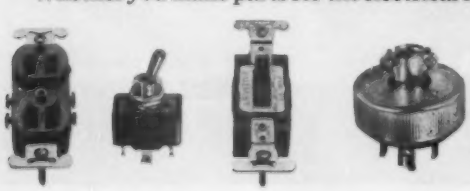
WHEN LEVITON MAKES A SWITCH, THEY USE ALCOA ALUMINUM SCREW MACHINE STOCK

Leviton Manufacturing Company first substituted aluminum for scarcer materials. Today, new parts are designed first for aluminum, and the other materials are viewed as substitutes.

For over thirty years, Leviton has specialized in the manufacture of fine electrical wiring devices for residential, commercial and industrial use. Today the company is the largest in its field and operates a huge main plant in Brooklyn, New York. Other plants are at Hillsgrove, Rhode Island; Montreal, Canada; Chicago and Los Angeles, with sales offices in all major cities of the United States and Canada.

Whether you make parts for the electrical industry, like Leviton, or market your products elsewhere, you'll find you can't beat Alcoa® Aluminum Screw Machine Stock for quality and economy. Cutting speeds as high as 1,000 feet per minute are not uncommon. Aluminum resists corrosion, offers excellent heat and electrical conductivity. Its light weight gives you up to three times as many parts per pound.

Alcoa wants to help you profit from aluminum screw machine stock's many advantages. Just call your nearby Alcoa sales office, listed under "Aluminum" in your phone book. Aluminum Company of America, 868-B Alcoa Building, Pittsburgh 19, Pennsylvania.



LEVITON

IN MANAGEMENT

Bernard Leviton, Executive Vice President and spokesman for the Standards Committee says, "Alcoa has been one of our suppliers since 1941. Since then, we have had a steady progression of changes to aluminum. Ours is a high-volume, high-production business. In any case where we've had a problem—whether materials, packaging or machining—Alcoa has the right man on the spot in 24 hours. And that man has the right answers. Alcoa's technical services are, in effect, an actual part of our developmental facilities. The jobs we've worked out together meet the high standards of Underwriters' Laboratories and Canadian Standards Association. At every level, Alcoa has made sure we are satisfactorily served."

IN ENGINEERING

George Smith, Chief Engineer, says, "We think Alcoa's engineering data and technical assistance set the standard and give us firm foundations of fact on which we can make decisions. I recall one specific case of many . . . Alcoa lubrication engineers gave us information that enabled us to increase tool life dramatically. Typical of the aluminum screw machine parts we make are components for toggle switches, including bat handles, bushings and mounting nuts. Close tolerances are a must. A variation of as little as .001 inch in some switch parts means the device just won't work. Yet, with aluminum, the parts fit together nicely, work smoothly."

IN PRODUCTION

Edward Palczewski, Foreman of the Screw Machine Department (shown with operator), says, "We've been cutting aluminum during the ten years I've been with Leviton. We have one job running on a high-speed Davenport which does 120 pieces a minute. It consists of forming, drilling, tapping and threading $1\frac{9}{32}$-inch rod. We're running the machine at top capacity. Swaging diminishes the machinability of some metals—takes away their free-cutting qualities. Aluminum's properties are retained no matter what we do with it—doesn't get stringy or lose machinability. During setup, tools can be set dry. The operator can see what he's doing—saves a lot of time. Cutting oils are lighter, cheaper. Stock is easier to handle."

IN PURCHASING

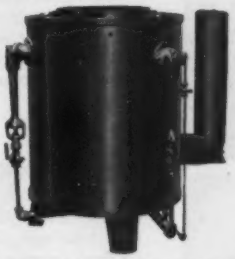
Joseph Wolfson, Purchasing Agent, says, "Our Purchasing Department at Leviton demands dependability from suppliers. It is this simple fact that has characterized our relationship with Alcoa for over 15 years. Use of Alcoa Aluminum Screw Machine Stock has helped us to reduce our inventory and order problems; for example, one Alcoa alloy offers advantages of free cutting and free swaging. Once, when we increased production on a certain job and ran into low-stock problems, Alcoa's early delivery service really helped us out."

Your Guide to the Best in Aluminum Value

BUZZER
REG. U. S. PAT. OFF.
INDUSTRIAL GAS EQUIPMENT
BURNERS & FURNACES (Heat Treating, Melting, Soldering)

NO BLOWER OR OTHER POWER NEEDED
. . . just connect to gas supply!

Outstanding service since 1911! Each unit, with the famous "BUZZER" Venturi, delivers the hottest, quickest heat attainable without a blower. Full range control of heat and turn-down. Standards or specials available for manufactured, natural or liquefied gas applications.



ATMOSPHERIC POT FURNACES for cyanide, salt bath and lead hardening — temperatures to 1650° F.

BENCH TYPE OVEN FURNACES for heat treating and pre-heating temperatures to 2000° F.

WRITE FOR NEW "BUZZER" CATALOG

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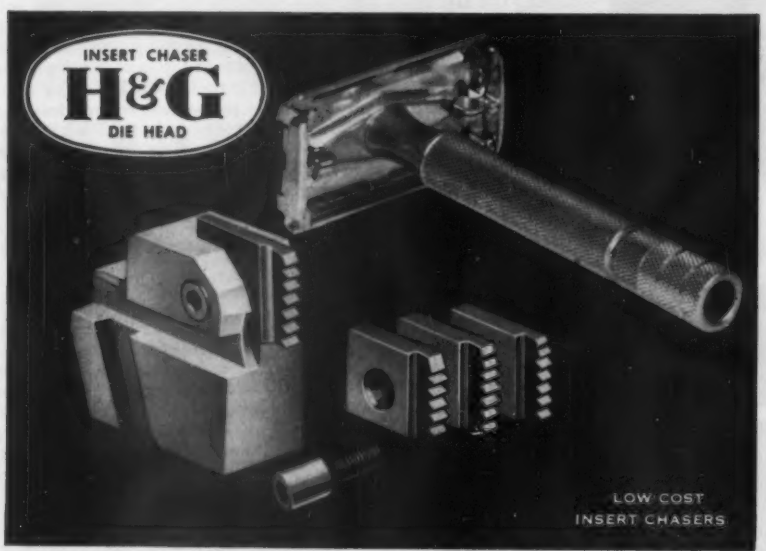
121 S. Grand Avenue, Baldwin, L. I., New York • BAldwin 3-1110



FOR LESS THAN $45 YOU GET 12 SETS, EACH SET GROUND READY TO GO

Men would not accept either idea at first . . .

INSERT CHASERS SAVE UP TO 33%

Insert chasers are like safety razor blades: they cost so little that you can throw them away when dull. Or, for utmost economy, you can resharpen them over and over again. Only a flash grind is required. For less than **$45** you get a dozen sets of ¾–16 insert chasers, each set ground ready to go. You will be amazed at the quantity of threads they will cut, even to Class 3 specifications, with a minimum of downtime.

THE EASTERN MACHINE SCREW CORPORATION 20-40 Barclay St., New Haven, Conn.

New Books...

METALLURGY. FOURTH EDITION. *By Carl G Johnson, associate professor of mechanical engineering, Worcester Polytechnic Institute, and William R Weeks, assistant professor of industrial technology, Western Michigan College of Education. Published by the American Technical Society, 848 East 58th St, Chicago 37. 454 6x9-in. pages. Price $5.50.*

For years, engineers and shop men have used this book to familiarize themselves with the basic concepts of metallurgy. The information in the 17 chapters is written in a straightforward manner for easy self instruction or reference. The treatment is not exhaustive, but the material is up to date. Therefore, the book serves to get the reader acquainted with the subject and to condition him for intensive study of any particular phase of metallurgy, according to his needs.

As a reflection of modern trends, the authors have included a new chapter on titanium, zirconium, indium and vanadium. The information here is largely concerned with properties and uses, but virtually nothing is said about machining, welding or pressworking these materials.

The fourth edition merits consideration by persons building a library or needing instruction in metallurgy from ore to finished material. Too often, the emphasis in books is restricted to one phase, whereas the man fabricating a material should know what has happened to a metal before it reaches him.

•

HANDBOOK OF SCIENTIFIC AND TECHNICAL AWARDS IN THE UNITED STATES AND CANADA, 1900-1952. *Published by Special Libraries Association, 31 E 10 St, New York 3, NY. 491 pages. Price $10.00.*

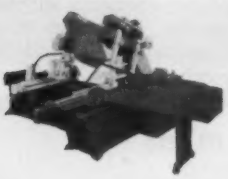
The type of award given, the criteria for selecting winners, and a chronological list of recipients are reported for each award granted by selected American and Canadian scientific and technical societies. The papers presented in connection with an award, biographical data, and other related information are presented, together with indices of awards,

New from DoALL...

The First Low Cost, High Efficiency Cut-off Saw specially designed for Demon® high speed steel Saw Bands

DoALL DEMON BLADES
cut sawing costs 50% or more

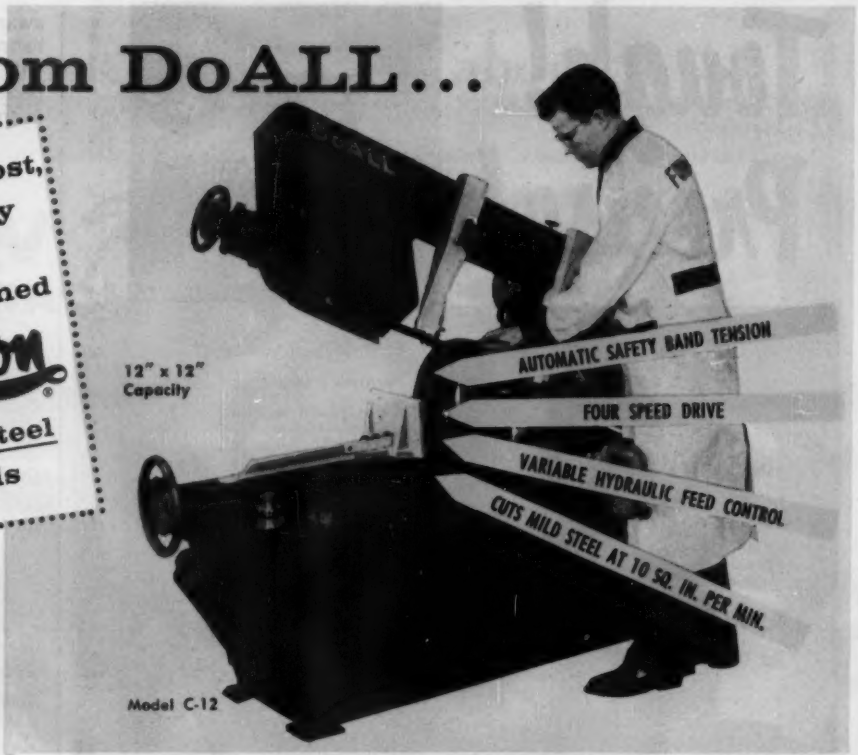
The *red heat* hardness of high speed steel saw slices through steel—outlasting and outperforming any other band tool.



Model C-58 ***automatic Cut-off Machine*** **. . .** *for accurate sustained* production cut-off. Automatic indexing. Inf. variable speeds. Any type of material to 12" x 12". Standard index to 24"; multiple index available.

Big Material Savings Pay Tool Cost

Thin Demon blade reduces stock waste, pays its way in longer life and raw material "bonus".


12" x 12" Capacity
AUTOMATIC SAFETY BAND TENSION
FOUR SPEED DRIVE
VARIABLE HYDRAULIC FEED CONTROL
CUTS MILD STEEL AT 10 SQ. IN. PER MIN.
Model C-12

Saves money in any shop—faster work, smaller investment, lower operating cost

Now *any shop* can afford the speed and economy of cut-off band sawing. The new DoALL Model C-12 is built with the rigidity, feed control and coolant system needed for Demon high-speed steel blades—blades that will withstand cutting speeds and pressure temperatures of up to 1100° without losing tooth hardness—blades that will cut up to 6 times faster and last up to 10 times longer than carbon steel blades.

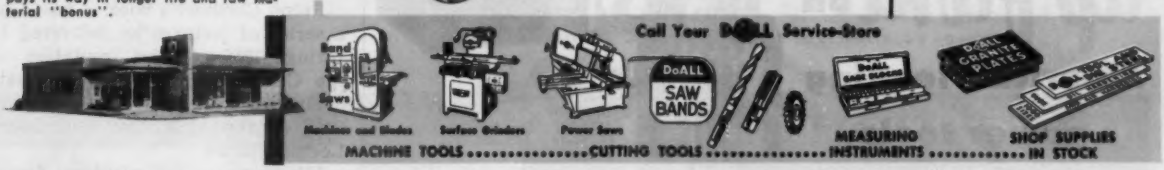
Here's what this can mean to you: The DoALL C-12 will cut up to *twice* as fast as a comparable power hack saw and up to *three* times as fast as any band saw of comparable capacity. Both tool cost *and* initial cost are less than a power hack saw and far less than a cold saw. And the thin kerf of the Demon blade gives you a "material saved" bonus that mounts with every cut taken—for the *life of the machine.*

But the big saving is in labor time. The C-12 is a practical, rugged, easy to operate machine designed and priced for economical operation—even on part time. Stock handling equipment optional. Write for details today on this fast, dependable, low cost machine or phone your local DoALL sales service store for a demonstration.

For Lowest Cost Per Cut—do it on a DoALL!

DoALL The DoALL Company
Des Plaines, Illinois

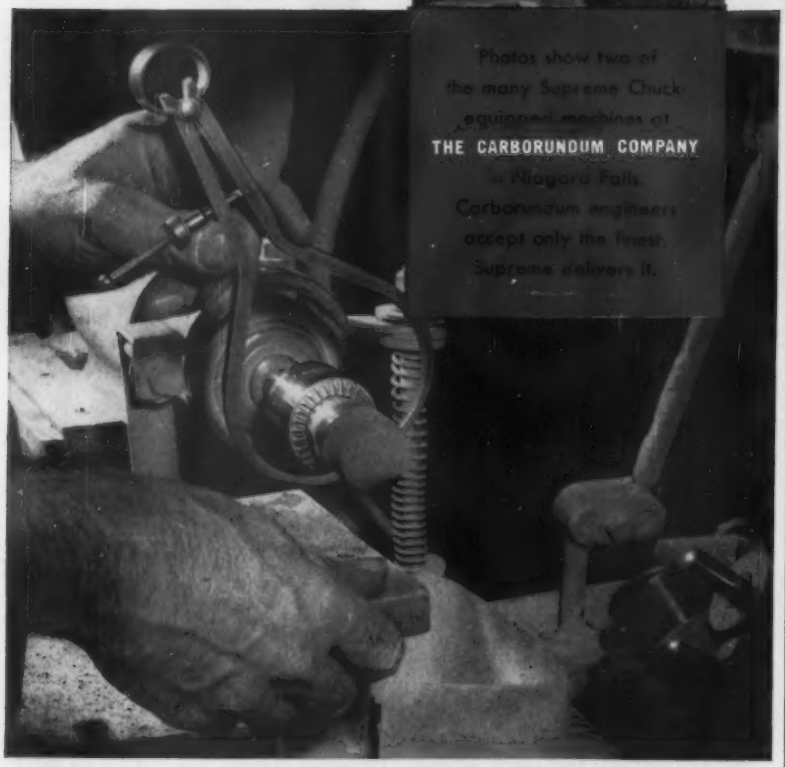
WRITE FOR LITERATURE
on new C-12 or for "Power Sawing Handbook".



PS-6

Friendly DoALL Stores in 38 cities give you personalized service and local delivery from complete stocks.

Tough! Precise!



Supreme Chucks are expertly hardened inside and out by an exclusive process that makes them last longer, maintain greater accuracy. They are fast becoming the choice of tool experts everywhere. Specify Supreme Chucks on all new tools. Insist on them for replacements. The line is complete . . . and fully interchangeable with other makes. An industrial distributor nearby can give you excellent service.

Supreme Chucks BRAND up front on America's leading power tools

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award names and recipients, and listings of each society. The book will prove useful to public relations personnel, newspapers, libraries, and scientific and academic institutions.

•

STANDARDS FOR THE INSTALLATION OF SPRINKLER SYSTEMS. *Published by National Fire Protection Association, 60 Batterymarch St, Boston 10, Mass. 162 pages. Price $1.00.*

This revised edition includes new material on trapeze bar hangers for sprinkler piping, covers all details of sprinkler installation, and is the general standard for such work throughout the country.

•

STANDARD TYPES OF BUILDING CONSTRUCTION (REVISED EDITION). *Published by National Fire Protection Association, 60 Batterymarch St, Boston 10, Mass. Pamphlet. Price $0.25.*

The purpose of this standard is to serve as a guide to NFPA committees and others who may wish to specify structural requirements without detailing specific assemblies of materials. It includes a new definition of noncombustibility, and various editorial changes.

•

NEW FRONTIERS FOR PROFESSIONAL MANAGERS—*By Ralph J Cordiner, President, General Electric Company. Published by McGraw-Hill Book Co, Inc, 330 W 42nd St, New York 36, NY. 121 pages. Price $2.75.*

Here, by a man well qualified to define the issue, is a serious and thoughtful attempt to "help bridge the disturbing gap between current political and economic theories and the living realities of the new American economy." This book is frank and forthright.

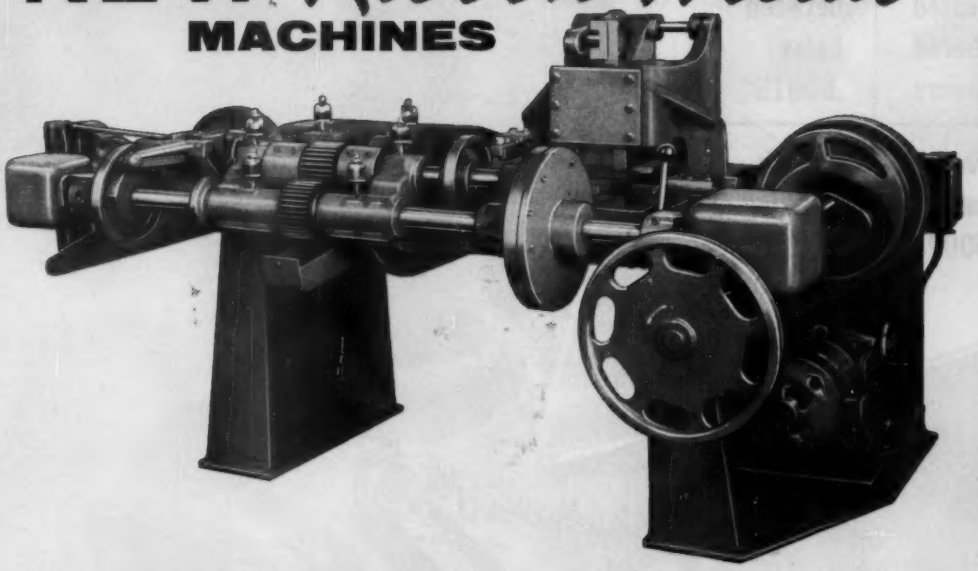
Ralph Cordiner's book is based on a series of lectures he delivered in spring, 1956, at the invitation of the Columbia University Graduate School of Business. It is the first volume of the McKinsey Foundation Lecture Series.

What are the big problems facing

(Continued on page 240)

...ask BAIRD about it

NEW *Ribbon Metal* MACHINES



Open UNEXPLORED opportunities for cost reduction in manufacture of a wide range of parts.

- HIGH SPEED
- UNIFORM PRODUCT
- LOW TOOLING COST
- EASY MAINTENANCE
- SIMPLE OPERATION
- UNLIMITED RANGE

If you are producing small . . . or even quite large . . . formed parts out of ribbon wire or metal strip up to about 2" wide, it will most certainly pay you to "ask Baird about it." More and more quality and cost-conscious manufacturers are finding that our NEW model Automatic High Speed Ribbon Metal Forming Machines are the ideal "production line" for such products.

Behind these machines are years of successful application to a range of work "limited only by the ingenuity of the men who design the tooling." NEW models include a host of important improvements and additional features which greatly extend the range of work and tooling possibilities. For example, what is essentially a substantial press is built right into the machine and is capable of maintaining precision in high-speed production. Baird's unique two-to-one feeding mechanism and EASY cam motions, combined with the fact that 3/4 of the cycle is available for forming rather than the usual 1/2-cycle, permits far greater latitude in combining operations and complexity of possible forms.

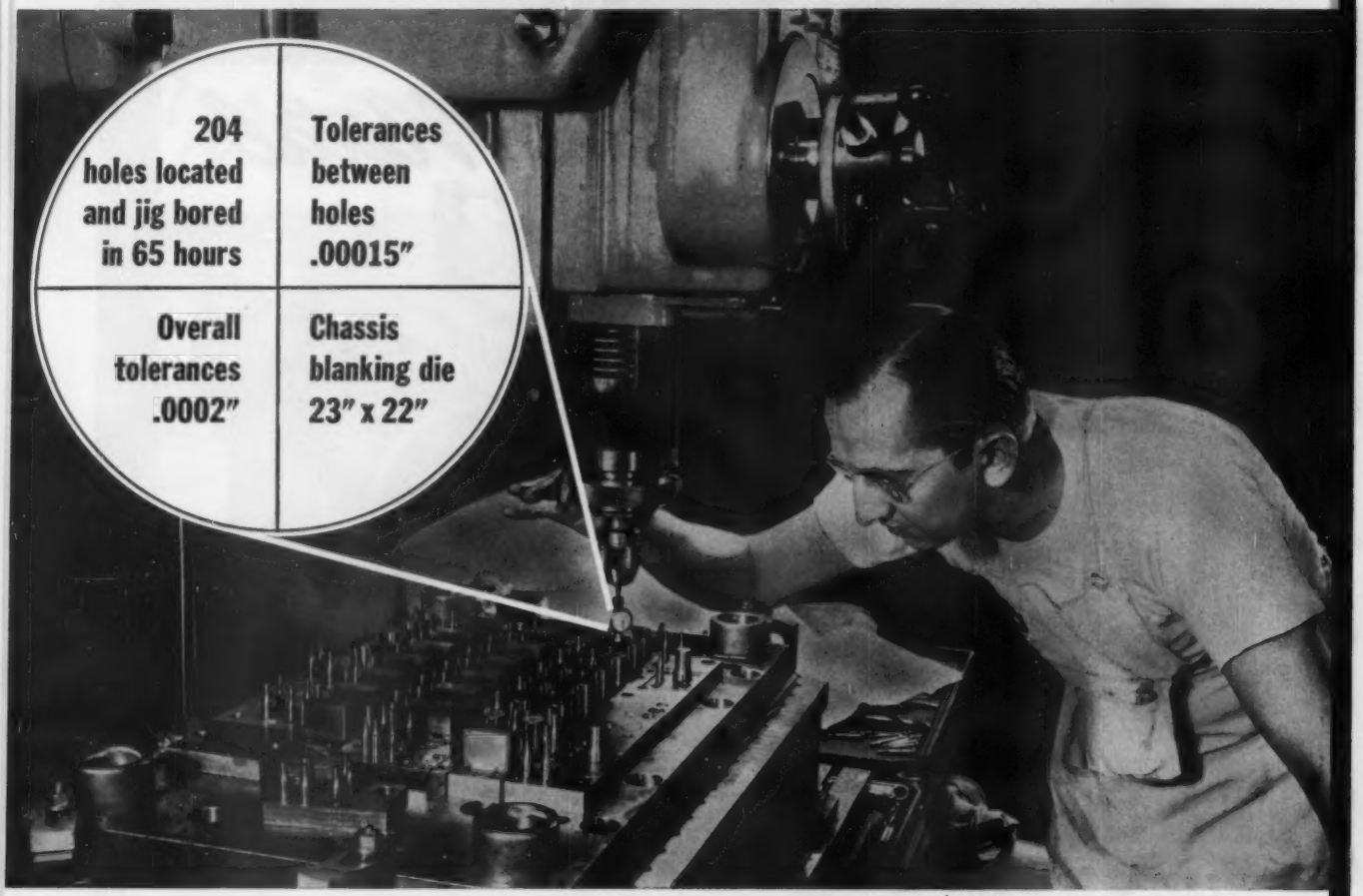
Our Engineering Department will be glad to give you further detailed information or to submit recommendations on parts or prints of your product. Write Dept. AM.

Interested in Deferred Payment? . . . "ask Baird about it."

THE BAIRD MACHINE COMPANY
STRATFORD CONNECTICUT

78A56

Why Lindner Optical Jig Borers have changed so many ideas about jig boring


204 holes located and jig bored in 65 hours
Tolerances between holes .00015"
Overall tolerances .0002"
Chassis blanking die 23" x 22"

MODEL LB15 (WITHOUT AUTOPOSITIONER) AT MIDDLESTADT

You're looking at the *third* Lindner Optical Jig Borer at work for Middlestadt Machine Co., Baltimore. And you'll see *seven* Lindners at General Electric; *five* at North American Aviation; *three* at Avco; others at General Mills, Lockheed, Vectron, Bendix—and a growing list of more precision-minded plants. Here's why:

Optical measuring system does not depend on lead screws, gage blocks, bars or limit switches—is permanently protected against mechanical wear. Only a light beam touches helically scribed cylindrical measuring scales which are independent of table movement mechanism and are *immovable* in axial direction.

AUTOPOSITIONER® enables operator to preselect table position for next hole while one boring operation is in progress—eliminates non-productive time between holes. As one hole is completed, table moves in rapid traverse to the next preselected position. (Available only on model LB15A)

Photo-electric optical centering device minimizes visual fatigue and errors in settings—permits initial and repeat settings guaranteed accurate within .00015" and readings in .00005".

Projection screen eliminates operator eye strain and bending—helical line from measuring scale is projected on 2½" x ¾" screen which operator reads in standing position without eyepiece.

Automatic table clamping prevents errors in clamping and unclamping table between movements.

Lindner Optical Jig Borers are available in two models:
LB15A with Autopositioner—Table size 44" x 24"
LB14—32" x 16" (without Autopositioner)

● ***Send for 25-minute movie film demonstration***

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KURT ORBAN COMPANY, INC.

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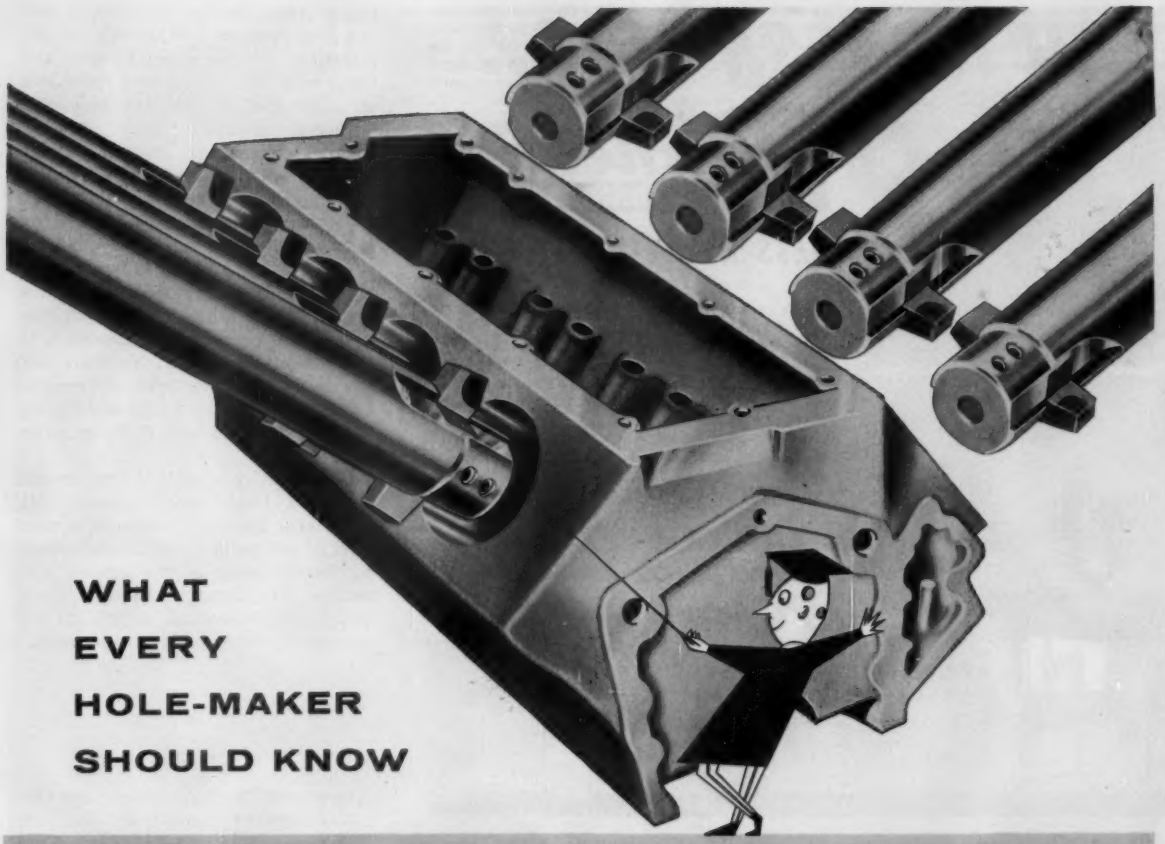

WHAT EVERY HOLE-MAKER SHOULD KNOW

ABOUT MADISON ROUGH AND FINISH BORING TOOLS

Let the man with the holes in his head tell you how to cut costs in:

- ★ **Boring**
- ★ **Reaming**
- ★ **Deep Hole Drilling**
- ★ **Trepanning**
- ★ **Roller-Burnishing**
- ★ **Gaging**

Interchangeability — Cutters are changed in seconds without removing bars from machine because all Madison cutters are presized and uniform . . . minimum down time.

Controlled Float — Exclusive Madison feature lets cutter float in bar at point of cutting action, eliminates need for costly special floating tool holders.

Free Cutting Action — Two cutting edges leave room for chip clearance and coolant circulation, prevent damage to tool and work from overheating.

One-Screw Adjustment — Micrometer adjusting screw sets tool to exact desired size. Work is held to closer tolerances. Madison expansion feature assures maximum cutter life.

Your Madison Man would like to tell you about other Roughing and Finishing Tool features — and demonstrate their benefits on *your* holes. Send coupon.

Inner Diameters Are Our Business

MADISON
INDUSTRIES INC.
Muskegon, Michigan

ASSOCIATED WITH MADISON — FAESSLER TOOL CO.

MAIL COUPON TODAY

☐ Please send me literature on Madison Rough and Finish boring tools.
☐ Have representative call. Dept. AM-2

NAME _____
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FRICTION SAWING...

with

Tannewitz

HIGH SPEED BAND SAWS

NETS AMAZING SAVINGS

Most everyone is truly amazed at the speed and practicality of friction sawing with these machines. Cutting sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings and cutting formed parts are among the many operations in which it effects tremendous savings. Cuts are smooth and down-drag is so little that no rests are usually required. It will pay you to get the facts. Just ask for "FRICTION SAWING" booklet.

The TANNEWITZ WORKS

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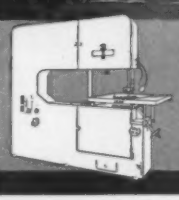
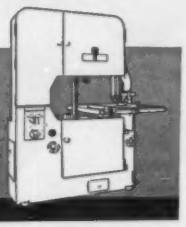


TANNEWITZ DIE-SAWS

24", 36", 48", 60" CAPACITIES

for CONTOUR SAWING, FILING, POLISHING

The smoothest, fastest, most trouble-free Di-Saws on the market. Write for bulletin.



TOWNSEND of Hartford

LOW COST AUTOMATION

Townsend's engineering, development and manufacturing facilities have an established record of efficiency and customer satisfaction. *Look to Townsend* for the answer to your next production problem.

CLEVELAND TAPPING* special index type machine for drilling, spotfacing, milling and tapping.

*subsidiary of H. P. TOWNSEND

TOWNSEND of Hartford now has a complete line of automatic machines to fit every production need: Automatic screw machines, Riveters, Spring presses, Drilling machines, Duplex spline milling machines, Automatic metal sawing machines, Lead screw tapping machines, Automatic drilling and tapping machines.

The H. P. TOWNSEND MANUFACTURING CO.

HARTFORD 10, CONN.

major corporations in today's expanding economy? What are the implications for management men and those who deal with them? How does an individual fit into the new corporate dimensions?

Now, starting on Page 1 with a definition of the new form of capitalism, aptly described as a "people's capitalism," which has evolved in the United States (in contrast to the Old World concepts of capitalism and socialism), Mr Cordiner describes the proper place and function of the large-scale economic organization in the national economy. He tears into the sharp, and wasteful, differences between academic theory and the actualities of American business practice.

Chapter by chapter, the author discusses these new corporate dimensions, decentralization as a managerial philosophy, the breakthrough to the demands of the future, and, finally, the General Electric Company's objectives as a key to the economic direction of "big business."

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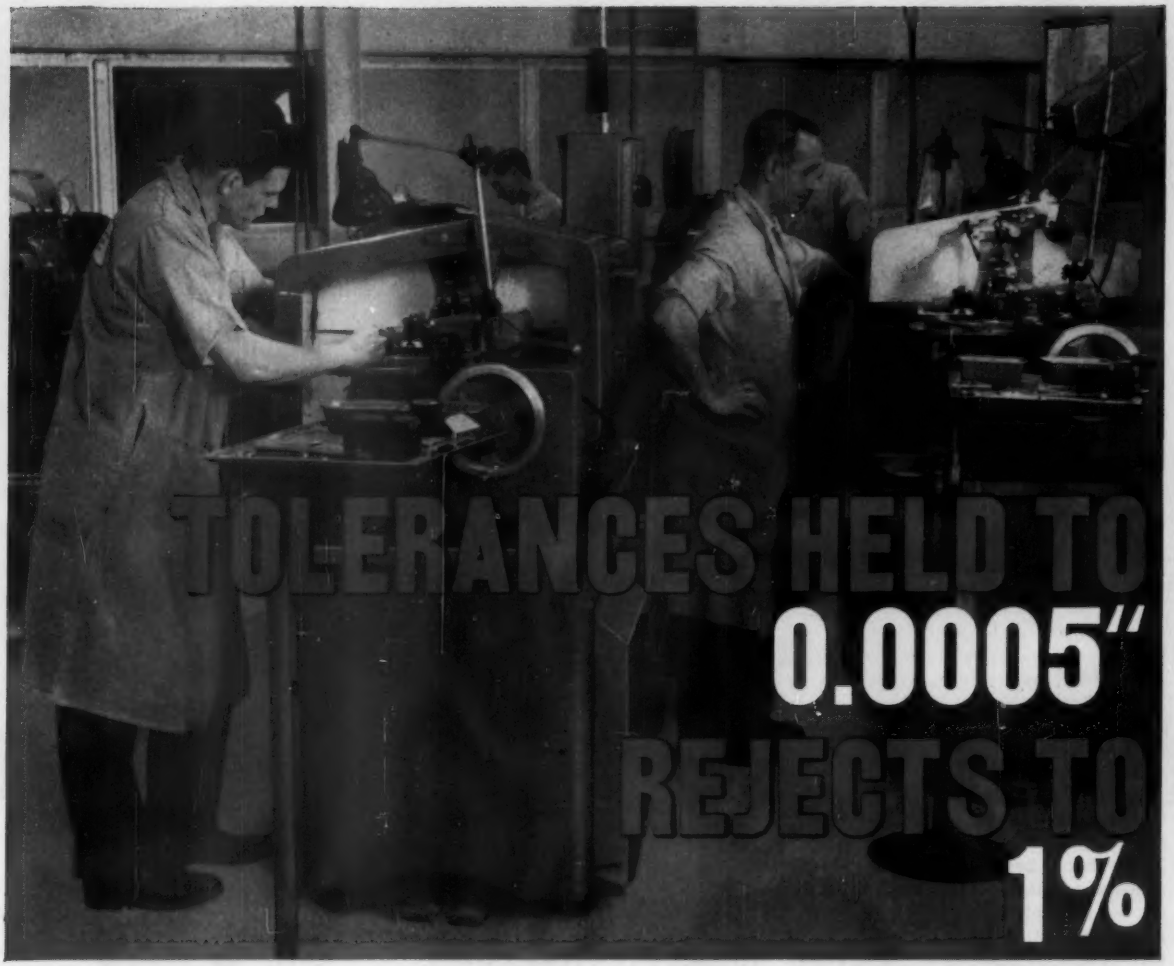
CONTRACTS, SPECIFICATIONS AND ENGINEERING RELATIONS—*3rd edition—(McGraw-Hill Civil Engineering Series)—By Daniel W Mead and Joseph Reid Akerman. Published by McGraw-Hill Book Co, Inc, 330 W 42nd St, New York 36, NY. 427 pages. Price $7.00.*

Rewritten by the staff of Mead and Hunt, Inc, consulting engineers of Madison, Wisconsin, the purpose of this book remains unchanged in setting forth the important functions and relationships with which the engineer or the architect should be familiar. The basic treatment of ethical values closely follows the treatment originated by D W Mead, the original author. Fundamentally, this book is a text for students. However, while it is concerned directly with problems of civil engineering and construction, this text should have a very practical value to the engineer or executive responsible for contracting and particularly to the person involved in planning the construction of a new plant or an addition to an existing structure.

All chapters have been rewritten and much of the text material has been reorganized. The style of English has been modernized to correspond with current usage, and the chapter devoted to the use of English

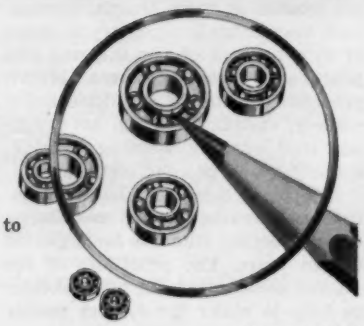


by Brown & Sharpe Automatic Screw Machines at Miniature Precision Bearings, Inc.

Ball bearings as small as .1000" O.D. meet critical specifications at Miniature Precision Bearings, Inc., Keene, N.H. Each tiny bearing component is held to severe tolerances. For example, the battery of B&S Automatics which produces the inner and outer race blanks and turns the races, maintains runout tolerances as close as 0.0005" Total Indicator Reading on diameters less than .0300". And rejects average only 1%!

The B&S Automatics save additional time too. On tough 52100 chrome steel bearing components, their super-accuracy lengthens carbide-tool life between sharpenings by as much as 4 hours! What's more, operators can work to closer dimensional limits with minimum set-up time. And secondary operations are minimized.

This is just one example of the increased accuracy, efficiency, and economy that Brown & Sharpe Machine Tools are making possible in every phase of metalworking. For *best* results in your milling, grinding, or screw machine operations, get complete information from Brown & Sharpe Mfg. Co., Providence, R. I.



These are typical products of Miniature Precision Bearings, Inc., Keene, N.H., the first U.S. plant specifically built for production of miniature ball bearings from .1000" to .3750" O.D. MPB bearings are used in products as widely different as clarinet keys and radar equipment—all must pass rigid tests for both accuracy and stamina.

SPECIFICATIONS: New High-Production B&S No. 00 Automatic

Takes stock diameter to	½"
Turns any length to	1"
Spindle speed range	7200 to 34 R.P.M.
Number of 2 speed combinations	208
Ratios of high to low speeds	2.3:1 to 16:1

Brown & Sharpe B·S

in business reports and letters reflects this modern usage.

In the chapters dealing with legal matters every effort has been made to use legal terms precisely, but the language used was selected, wherever possible, to be readily understood by the layman.

A complete set of specifications, recently issued by a consulting engineer and used for actual construction work, has been included as an appendix. Similarly, an extensive list of societies and associations that distribute standard specifications for materials and processes is included

•

APPLIED METALLURGY FOR ENGINEERS—*By Malcom S Burton, School of Chemical and Metallurgical Engineering, Cornell University. Published by McGraw-Hill Book Co, 330 West 42nd St, New York 36. 407 pages. 6x9 in. Price $7.50.*

Here is an excellent book on the elementary principles and applications of metallurgy. But, although the book is "elementary" in character, it is surprising to find a very good exposition on tensile-strain diagrams. This information is essential to those who work in the fields of cold extrusion and metal forming.

The book begins with brief discussions of the nature of metals, production of metals, methods of examining and testing metals, and the nature of alloys. Equilibrium diagrams are treated at some length, because such knowledge is necessary to proper development of the theories and practice of heat treatment. Metal-processing methods are discussed—namely, casting, molding, hot working, cold working, welding, brazing, soldering, and powder metallurgy.

Altogether this book shows the results of teaching applied metallurgy to engineering students for a period of ten years. The principles of the subject are stressed; the many sketches help to make the subject matter clear and quickly grasped.

•

ONSET OF FAST CRACK PROPAGATION IN HIGH-STRENGTH STEEL AND ALUMINUM ALLOYS—*By G R Irwin, Naval Research Laboratory. Published by Office of Technical Services, US Dept of Commerce, Washington 25, DC. Report No PB 121224. 16 Pages. Price 50¢*

Force tendency, a concept of driving force per unit crack front, is applied to fracturing in metals. Measured values of the crack extension force at the onset of materials are shown. Practical use of critical values of crack extension fore is illustrated.

•

PROFESSIONAL CONSULTANTS' OPERATIONS AND TECHNIQUES—*By C C Crawford. Published by Los Angeles Chamber of Commerce, Los Angeles, Calif. 46 pages 8½ x 11. Paper bound, stencil duplicated.*

Designed to aid the consulting profession to become even more effective in the advancement of business and industry, this unusual work should prove extremely interesting to those to whom it is directed. It gives practical information on how to find prospects for professional consulting services, how to sell those services, how to serve the client, and how to administer consulting operations. Other chapters are concerned with ideas for advancing the consulting profession, and how to organize good meetings and programs.

•

KEMPE'S ENGINEERS YEAR-BOOK 1957 (62ND EDITION)—*Edited by C E Prockter. Published by Morgan Bros Ltd, 28 Essex St, Strand, London W.C. 2, England. 2 Vols. 2740 pages 5 x 7. Price $11.50 plus postage.*

This new edition of an authoritative and well established handbook contains a substantial amount of new and revised material. The old chapter on gearing has been almost completely re-written, and there is considerable new material on hydraulic copying lathes, new types of tipped tools, transfer machining, shot blasting, and revised British Standards. The section on iron and steel now has new data on high-temperature alloys and nickel alloys, and the nonferrous section contains revised tables and new text dealing with magnesium and titanium. Under the Foundry heading, there is more detail on shell molding and the carbon dioxide method of core and mold making.

The section on railway engineering has been expanded, as have several of the other major sections to a greater or lesser degree, making this year's edition just about as up to date as it can possibly be.

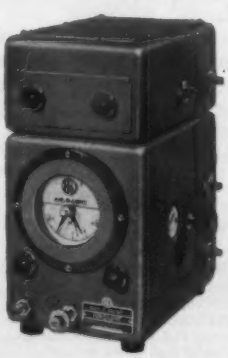
BUILD A GAGE INSTALLATION TO SUIT YOUR NEEDS . . .

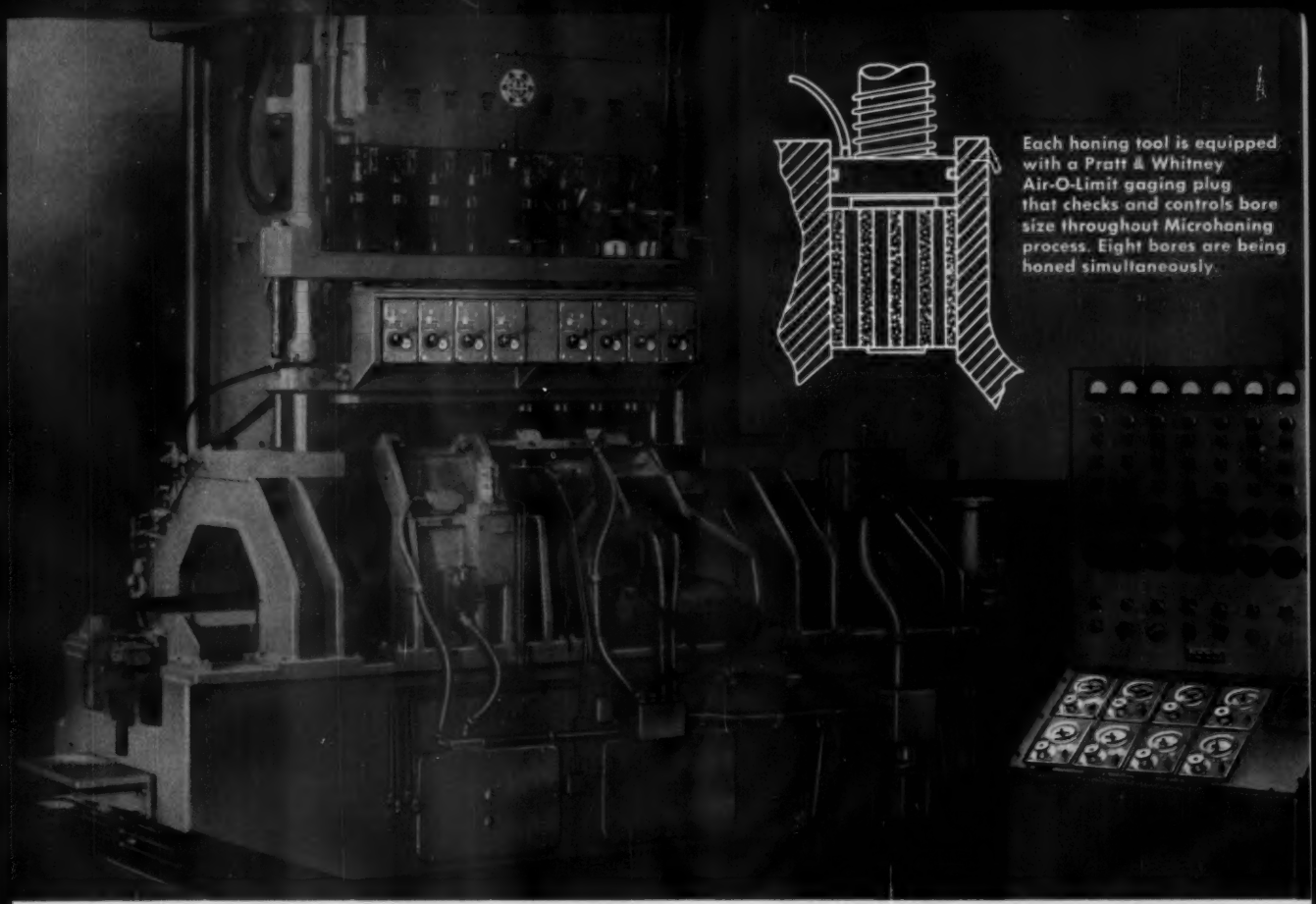
with these packaged, on-the-shelf P&W Air-O-Limit Light Signal Units. Can be used to signal operator or to provide feed-back impulse for fully automatic process control.

BASIC 2-LIMIT UNIT . . . indicates high and low tolerances. Suitable for sorting and other "yes-or-no" control applications.

3-LIMIT UNIT . . . especially suited for grinding and similar operations. Indicates or automatically controls such conditions as: "Fast Feed," "Slow Feed," and "Spark-Out."

4-LIMIT UNIT . . . similar to 3-Limit Unit, but provides greater control scope. Indicates or controls such conditions as: "Approach High Limit," "High Limit," "Approach Low Limit" and "Low Limit."





Each honing tool is equipped with a Pratt & Whitney Air-O-Limit gaging plug that checks and controls bore size throughout Microhoning process. Eight bores are being honed simultaneously.

PHOTO COURTESY OF MICROMATIC HONE CORPORATION, DETROIT, MICH.

Make Your Investment in Precision Pay Off in PRODUCTION

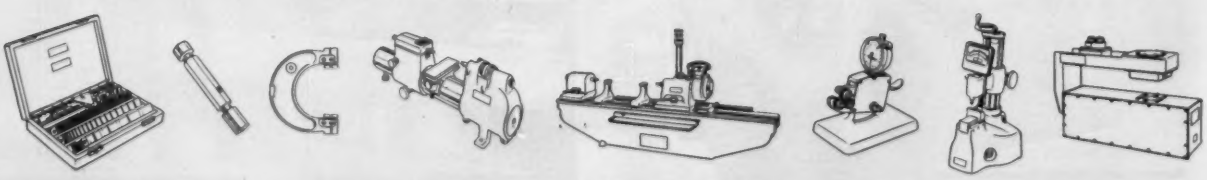
• • • • WITH PRATT & WHITNEY "PACKAGED" AUTOMATION GAGE UNITS

Applied to your precision production machines, "P&W Automation Gaging" will make it possible for you to increase production, reduce scrap losses and put to work more effectively the high precision built into your equipment. And in addition, the use of Pratt & Whitney standard, on-the-shelf Packaged Gage Units will provide an installation *custom-tailored* to your exact needs *WITHOUT* the expense and delays involved in engineering and constructing special controls.

In this example – a Micromatic Hydrohoner – automotive cylinder blocks are gaged *during* the Microhoning process. When final size is reached, the machine is automatically shut off and the Microhoning tools are retracted. A change to a different bore size can be made, without stopping the machine, by a simple adjustment on a calibrated gage control dial. Visual indication is given of the accuracy of the new adjustment. Cylinder blocks are produced at a rate of 120 per hour. Reject and scrap losses are virtually eliminated.

Make the most of *your* investment . . . make it a point to call in a P&W Field Engineer to analyze your production requirements and recommend the right P&W Automation Gaging installation to help you increase output, improve accuracy and reduce reject losses.

Pratt & Whitney Company, Incorporated,
11 Charter Oak Boulevard, West Hartford, Connecticut.



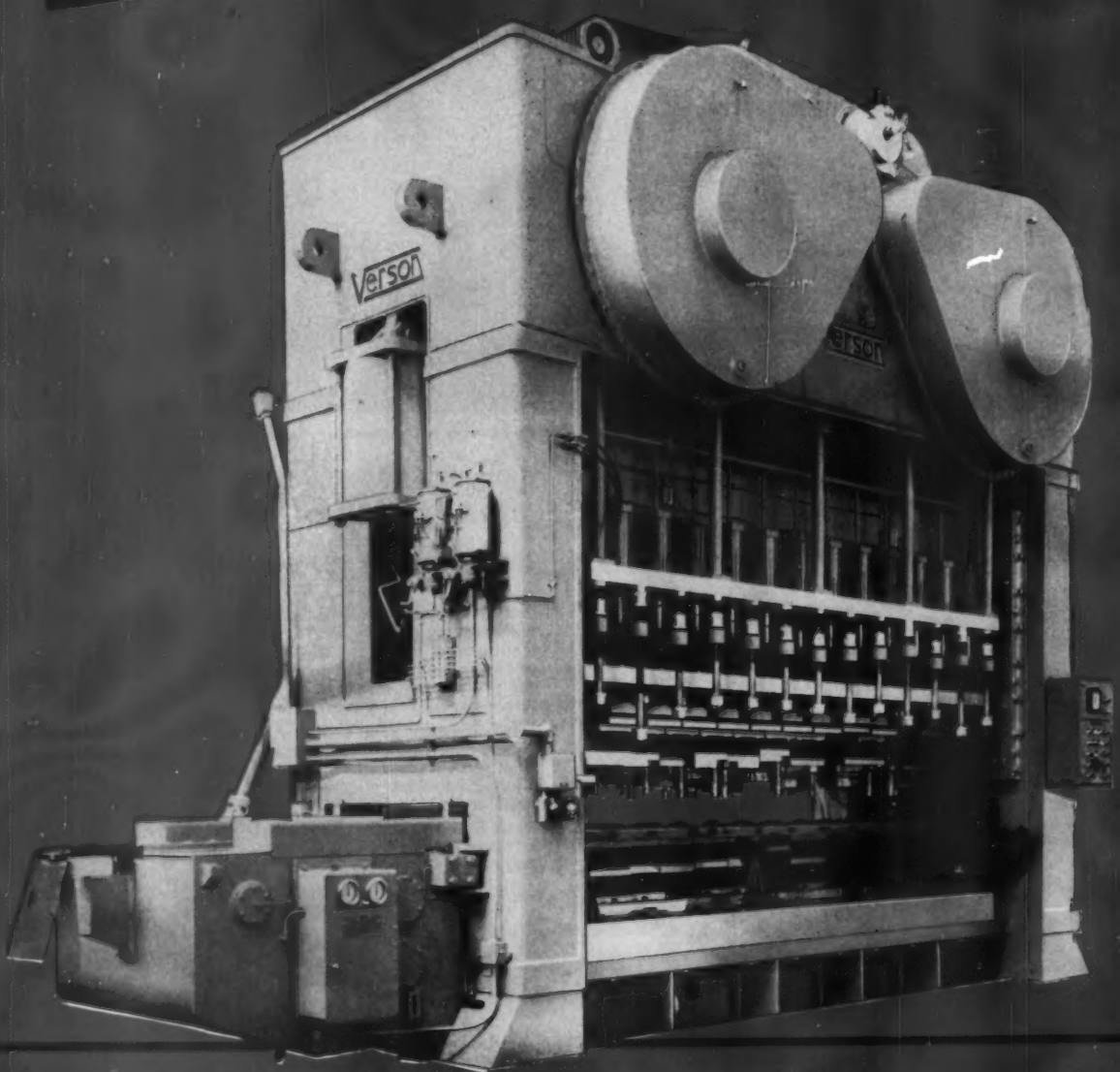
GAGE BLOCKS . . . CONVENTIONAL GAGES . . . SUPERMICROMETERS . . . STANDARD MEASURING MACHINES . . . COMPARATORS . . . AUTOMATION AND CONTINUOUS GAGES

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

TRADE Verson MARK TRANSMAT



A typical 600 ton Verson Transmat Press which performs a total of 15,000 press operations per hour on electric motor housings.

FORMING...

The Proven Precision Method for Mass Production Stamping

HERE'S THE PROOF...

COIL CONTAINER

In ten years over 50,000,000 automotive ignition coil cases have been produced by the Verson Transmat Process at a rate of 1300 per hour. The case is blanked and drawn from .15" stock and is 2" in diameter, 5" deep.

WASHER LEG

One of the first intricately shaped parts formed by the Transmat process over nine years ago, this washer leg is 21¼" long, 4" wide in 16 gauge steel. It was formed from pre-blanked stock at the rate of 900 per hour.

RANGE DRAWER

Formed on what was described ten years ago as the "world's largest automatic deep drawing press", this drawer measures 15" x 18" x 6" deep. It is formed from .035" coil stock at the rate of 500 per hour.

AUTOMOTIVE SPRING SEAT

One of two types of seats produced on the same Transmat Press, the seat pictured measures 2" by 5¼" by 1⅝" deep. Two at a time are formed from ¼" stock at the rate of 2200 per hour. In production over a year.

● The production figures quoted above are not theoretical rates computed on the drawing board. They are verified production figures based on day-in, day-out experience over extended periods of time.

Only Verson, the pioneer of Transmat Forming can offer such proof of performance. Only Verson can offer the accumulated experience derived from the building of scores of Transmat Presses over a period of eighteen years.*

Out of this experience has come the knowledge that the first consideration in the design and construction of a Transmat Press must be the production of multi-operation stampings at the lowest possible cost. No other consideration can be allowed to interfere.

Therefore, if you must produce 4000 or more identical stampings daily which require four or more operations, Verson Transmat Presses offer you the best opportunities for slashing production costs. We welcome the opportunity to show you what Transmats can do for you. Write or phone.

**The first Transmat is still in service producing 1300 oil filter shells per hour.*

A Verson Press for every job from 60 tons up.

TRADE Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

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MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES
TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

"Ex-CL-Treat"

A CHICAGO-LATROBE EXCLUSIVE

Regular industrial users of Chicago-Latrobe Drills and Reamers have come to expect extra mileage from Chicago-Latrobe products. There are a lot of good reasons for this, but one of the foremost is the *extra* heat treatment that we call "Ex-CL-Treat." "Ex-CL-Treat" is an exclusive with Chicago-Latrobe, as are these performance advantages that "Ex-CL-Treat" produces:

(1) **Greater lubricity** for more efficient chip clearance.
(2) **Reduced galling** that prevents loading on margins.
(3) **Strain reduction** that lengthens tool life.
(4) **Added toughness** that means less breakage.

If you have any reason whatsoever to question the performance of the drills you now use, we invite you to consult a Chicago-Latrobe Distributor. It is likely that Ex-CL-Treat can solve your problem.

"Ex-CL-Treat" Drills and Reamers... only from

Chicago-Latrobe

DOUBLE CIRCLE TOOLS

CHICAGO-LATROBE • 416 W. Ontario St., Chicago 10, Ill.
OFFICES AND WAREHOUSES
NEW YORK • DETROIT • CHICAGO • LOS ANGELES
The stocks are large and the service is great from your local Distributor. Call him.

New Films

TRANSFORMERS IN THE MAKING. *Produced by Wagner Electric Corp, 6400 Plymouth Ave, St Louis 14, Mo. 16 mm, sound, color. Running time 27½ min. No charge.*

Progressive steps in the manufacture of power and distribution transformers, including tank fabrication, coil winding, assembly, testing, and shipping, are shown in this film. Final scenes taken during actual installation of a large power transformer, stress the importance of adequate field service.

•

HOW TO MAKE A MOTOR GO—AND GO, AND GO, AND GO. *Produced by Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 35-mm slide film, sound, color. Running time 20 min. Available from nearest A-C Industries Group sales office. No charge.*

How to keep electric motors in good operating condition and insure top, long-life performance is demonstrated by means of cartoon characters and illustrations.

•

HOW TO TAKE STEP SEVEN. *Produced by Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 35-mm slide film, sound, color. Running time 20 min. Available from nearest A-C Industries Group sales office. No charge.*

How to install electric motors in the correct way is demonstrated by means of cartoon characters and illustrations.

•

PETE, THE PAINT BOSS, AND THE EFFICIENCY EXPERT. *Produced by Minnesota Mining & Mfg Co, Dept L6-321, St Paul, Minn. Slide film, sound, color. Running time 10 min. No charge.*

Based on discoveries from plant surveys, this strip shows that the cost of production material becomes more meaningful when considered on a

AUTOMOBILE RADIATOR SUPPORTS...*radially edge-bent in a single rapid operation with*

TANGENT BENDERS

Typical of the high production delivered by Struthers Wells Tangent Benders on products for the automotive industry, are steel supports for radiators. Here, the preformed, punched and notched channel is given two smooth bends in a single cycle, two units at a time, with production running several hundred per hour. Bending capacity like this awaits *your* large-volume needs —write us!

STRUTHERS WELLS CORPORATION

Machinery Division: **TITUSVILLE, PA.** • *Offices in Principal Cities*

Struthers Wells

Struthers Wells Products . . .

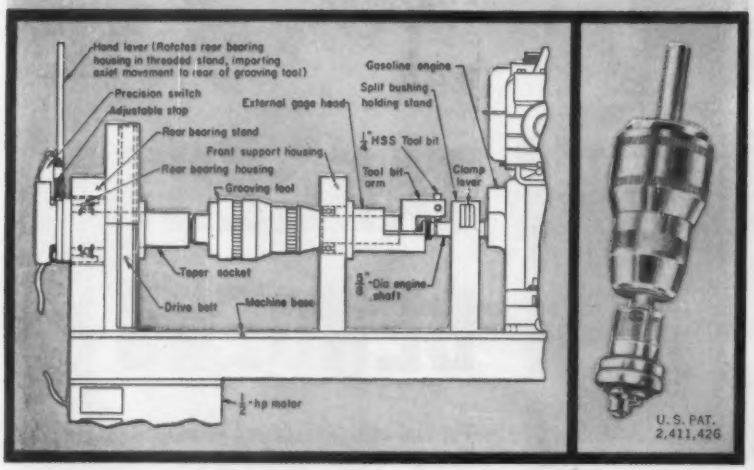
BOILER DIVISION BOILERS for Power and Heat . . . High and Low Pressure . . . Water Tube . . . Fire Tube . . . Package Units

FORGE DIVISION Crankshafts . . . Hydraulic Cylinders . . . Pressure Vessels . . . Shafting . . . Straightening and Back-up Rolls

PROCESSING EQUIPMENT DIVISION Crystallizers . . . Direct Fired Heaters . . . Evaporators . . . Heat Exchangers . . . Mixing and Blending Units . . . Quick Opening Doors . . . Special Carbon and Alloy Processing Vessels . . . Synthesis Converters

MACHINERY DIVISION MACHINERY for Sheet and Structural Metal Forming . . . Tangent Benders . . . Folding Machines . . . Roller Table and Tumble Die Bending Machines . . . Press Brakes . . . Punching and Notching Machines . . . Forming Dies

Groove cut in shaft of fully assembled engine with WALDES TRUARC GROOVING TOOL



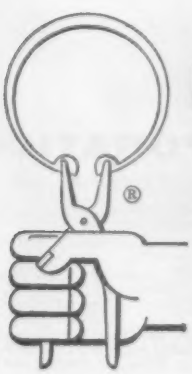
To install a small gear, Clemson Bros. must machine a recess (Tolerance: +.033" —.000") in a shaft of the engine for their power lawn mowers.

Engines arrive fully assembled. Normal procedure was to rotate the shaft. That involved removing a spark plug, mounting each engine firmly and accurately on a lathe, securing a gear or sprocket on the shaft, driving the shaft and moving the stationary cutting tool into position. The engine had to be reassembled after grooving.

All this costly time and labor was eliminated by holding the shaft stationary and *using a tool that rotates*—the Waldes Truarc Grooving Tool, equipped with an external grooving attachment. Because grooving dimensions are pre-set on the tool, there are no rejects caused by inaccurate cutting.

No recessing problem is too tough for this amazingly versatile tool. It's so simple, even unskilled labor can use it accurately...so cost-saving, it often pays for itself on a single small run!

Write now for 20-page manual containing full information on Waldes Truarc Grooving Tool.



WALDES TRUARC® GROOVING TOOL

WALDES KOHINOOR, INC.
47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

cost-per-job basis than on the usual basis of cost-per-unit of material. It demonstrates how the correct application of a masking tape best suited to a particular job can eliminate excessive costs caused by rework and rejects.

•

OPTICAL TOOLING. *Produced by Charles Bruning Co, 4700 Montrose Ave, Chicago 41, Ill. 16 mm, sound, color. Running time 35 min. No charge.*

By means of animated drawings and working models of optical instruments and tooling bars, the optical method of measuring, positioning, and aligning is presented in a simple, concise manner. The basic theory of optical tooling and its advantages over mechanical methods are explained, and specific applications in industrial research, design, and production are presented. Aircraft, automobile, and other models are used with setups of optical tooling equipment to illustrate the applications.

•

THE APPRAISAL OF EXECUTIVE PERFORMANCE. *Selected References No 71. Published by Industrial Relations Section, Princeton University, Princeton, NJ. 4 pages. Price 20¢.*

A bibliography of 15 references to executive rating, the pamphlet covers those books and articles dealing with general discussions, the development of appraisal tests, and company experience with various appraisal plans. A brief review of each is given.

•

CONSUMABLE INERT WELDING. *Produced by Electric Boat Div, General Dynamics Corp, and Arcos Corp, 1500 S 50th St, Philadelphia 43, Pa. 16mm, sound, color. Running time 12 min. No charge.*

This new film shows the use of a special EB weld insert for joining pipe by welding on one side only. Closeups show how the process produces root pass welds with smooth contours on the inside of the pipe. Other aspects deal with the impor-

tance of the process in producing crevice-free, corrosion-resistant welds. High-speed shots show the actual melting and fusion of the insert to form a smooth bead.

•

MATERIALS HANDLING FILMS. *Published by Materials Handling Institute Inc, Suite 759, 1 Gateway Center, Pittsburgh 22, Pa. No charge.*

Compiled from a survey of member companies of the Institute, this booklet lists all the films available on materials handling, with a brief description of the subject, size, running time, and where obtainable.

•

COLD WELDING. *Produced by Eutectic Welding Alloys Corp, 40-40 172nd St, Flushing 58, NY. 16 mm, sound, color. Running time 10 min. No charge.*

Maintenance welding problems at Thule Air Base, Greenland, where operations must be carried on at 30 to 40 below zero and in 100-mph winds, is the theme of this new picture, produced within 900 miles of the North Pole. Under these conditions, special techniques and procedures had to be developed for such essential jobs as repairing diesel cylinders and radiators, and aircraft fuel tanks. Just how these jobs were done with Eutectic's Low Heat Input process is shown in detail.

•

MECHANICAL AND HYDRAULIC HAND LIFT TRUCKS. *Produced by the Association of Lift Truck and Portable Elevator Manufacturers, Suite 759, 1 Gateway Center, Pittsburgh 22, Pa. 30-frame slide film, black & white. Running time 25 to 30 min. Price $2.00, complete with script.*

Suitable for training programs, refresher courses, and materials handling meetings, this strip covers the basic types of hand lift trucks and their operation, how to select equipment, and how to use it. Also included is a section on skids, pallets, load size factors, and common operating problems to consider before selecting hand lift trucks for an installation.

ACCO products

Wilson Diamond "Brale"* Penetrators

A Minor load penetration

B Major load penetration

C Linear measurement of penetration increase

To be SURE of your ROCKWELL* hardness test use only a

WILSON "BRALE" Penetrator

● WILSON Diamond "Brale" Penetrators are precision ground under high magnification to assure mathematical and microscopic accuracy. Each is standardized on test blocks and rigidly inspected at the WILSON Standardizing Laboratory.

Because of this meticulous attention to manufacturing detail, WILSON Diamond "Brale" Penetrators provide the extreme accuracy demanded of an instrument where the difference between a single degree of "ROCKWELL" reading is but 0.00008″ penetration.

Special "Brale" Penetrators are available for testing unique areas—the pitch line of gears, for instance, or high temperature testing. N "Brale" Penetrators are supplied for use with WILSON "ROCKWELL" Superficial Testers.

A WILSON expert on hardness testing is never more than a few hours away. Prompt WILSON service guarantees top performance from WILSON equipment.

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A FULL LINE TO MEET EVERY HARDNESS TESTING REQUIREMENT

Fully automatic

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Tukon Micro & Macro Hardness Testers

ACCO

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for Better Value

Automatic
POINTING MACHINES
for bolt and
cap screw pointing

TYPE 4600

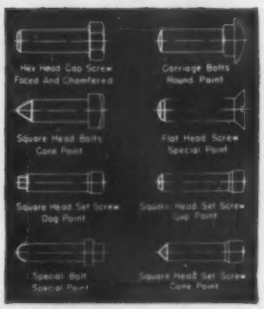
ECONOMY Automatic Pointing Machines are hopper fed and automatic in operation. These features enable operator to run several machines resulting in greater productivity and lower costs.

These Automatic Pointers are available in two sizes—Type 3300 for uniformly pointing bolts and screws to 3/8" diameter and 3/4" to 3-1/2" in length, the type 4600 for pointing bolts and cap screws 1/4" to 3/4" diameter and 1" to 6" in length. A single machine will handle all types of points on many types of bolts and cap screws.

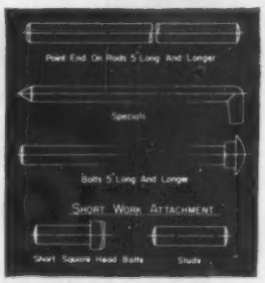
Production rates of the type 3300 vary infinitely from 2,000 to 6,000 finished parts per hour and on the type 4600 from 1800 to 5400 per hour.

Also available is the type "P" Semi-Automatic Pointing Machine for pointing bolts, cap screws, studs and rods 1/4" to 1-1/2" diameter, 5" or more in length. Production rates up to 2,000 pieces per hour make it a valuable secondary machine for short runs.

Consult ECONOMY on low cost, high production Bolt and Screw Pointing operations.


Hex Head Cap Screw Faced And Chamfered
Carriage Bolts Round Point
Square Head Bolts Cone Point
Flat Head Screw Special Point
Square Head Set Screw Dog Point
Square Head Set Screw Cup Point
Special Bolt Special Point
Square Head Set Screw Cone Point

Typical parts machined on the TYPE 4600

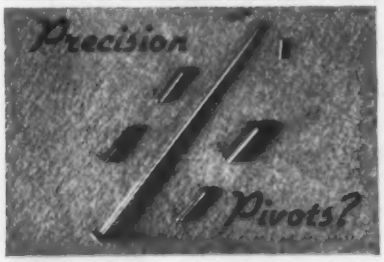


Typical operations performed on TYPE "P" Semi-Automatic Pointing Machines

THE ECONOMY LINE

Automatic Shaving Machines
Automatic Pointing & Shaving Machines
Automatic Pointing Machines
Semi-automatic Pointing Machines
Automatic Pointing & Threading Machines
Double End Automatic Pointing Machines

THE ECONOMY ENGINEERING CO.
WILLOUGHBY, OHIO
WILLOUGHBY-OHIO
Designers and Manufacturers of Secondary Operation Machines since 1915



The "spike" in the center is a common pin. The others are VK precision pivots.

Call **VK**

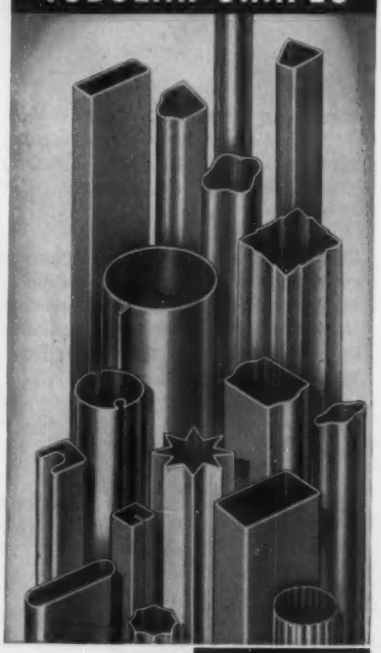
Steel, chromium plated, or carbide precision pivots to .013" diameter. 1 RMS or finer surface finish. Diameter tolerance to .000010". Chamfers, radii, lapped ends, etc.

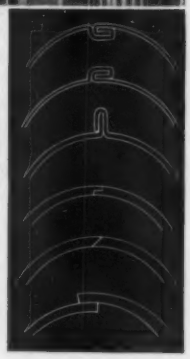
Also volume production lapping of flat or round production parts.

Send us your specifications.

The **VAN KEUREN COMPANY**
176-C WALTHAM ST. WATERTOWN, MASS.

COLD ROLL FORMING TUBULAR SHAPES





Among the wide variety of things you can make on a Yoder Cold Roll Forming machine are round, square, oval, rectangular and other tubular shapes, such as illustrated. The seams may be open, lapped, butted, dovetailed, interlocking, etc.—as shown in the drawing.

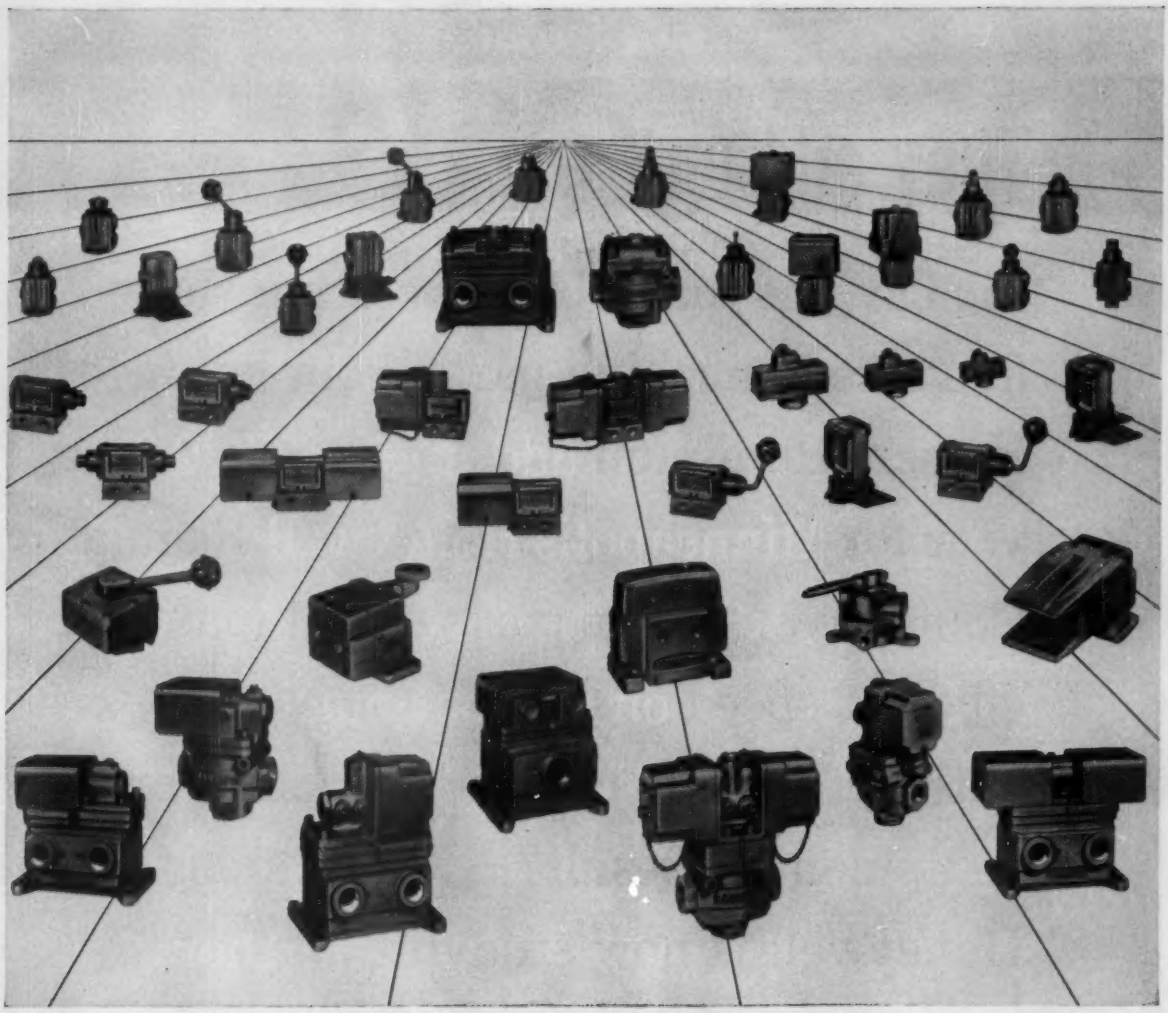
Millions of feet of such unwelded tubular shapes are made from coiled strip for conductor pipe, bedsteads, lamp stands, window channel, wiring raceways, carrying rods, etc. Production ranges from 20,000 to 50,000 feet per day, with only one operator and a helper.

Yoder offers you the cooperation of their engineering staff for designing and adapting their cold roll forming machines, auxiliaries, and tooling, for the low cost production of structurals, mouldings and trim, panels, tubular and other shapes, to meet individual needs.

The Yoder Book on Cold Roll Forming is a complete, illustrated text on the art and the equipment needed for performing a variety of operations which can be combined with cold roll forming, at little or no extra labor cost. A copy is yours for the asking.

THE YODER COMPANY
5519 Walworth Ave. Cleveland 2, Ohio

YODER
COLD-ROLL FORMING MACHINES



These valves like tough jobs

Discriminating engineers are finding that out. More and more of them are specifying Hannifin valves for every kind of directional air control—including the really tough jobs.

There are plenty of reasons why: Inspired simplicity of design. Fewer parts—and *those* easily and quickly replaceable. Ability to serve a wide range of applications with fewer valve models. And—above all—fast, smooth operation.

Your Hannifin man will gladly give you the whole story. We'll tell you where to get in touch with him—after you examine the big Hannifin catalog.

AIR CONTROL

HANNIFIN

VALVES

For this complete catalog showing all the Hannifin directional air control valves, write to Hannifin Corporation, 517 South Wolf Road, Des Plaines, Illinois.

They add up!...

the savings made by converting these five screw machine parts from brass to Kaiser Aluminum add up to $7,720.00 a year for Minneapolis-Honeywell Regulator Company...All five parts run at maximum efficient speed on present machines with little or no change in tooling or equipment...Result?—Minneapolis-Honeywell is now studying further conversions...If you bid for screw machine parts business, why not offer your customer savings like these with an alternate bid in...

Kaiser Aluminum

For complete information and expert assistance, call one of our many distributors, or look for our local number in your classified telephone directory.

Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois; *Executive Office*, Kaiser Bldg., Oakland 12, Calif.

See "THE KAISER ALUMINUM HOUR," Alternate Tuesdays, NBC Network. Consult your local TV listing.

Adjusting Knob
for Room Thermostat

Cost per 1,000 parts:
Brass $16.10
Aluminum 9.44
Savings .....$ 6.66
Percent Savings 41.3%

Cover Screw
for "Protecto Relay" Unit

Cost per 1,000 parts:
Brass $16.80
Aluminum 10.80
Savings .....$ 6.00
Percent Savings 35.7%

Tension Nut
for "Immersion Aquastat"

Cost per 1,000 parts:
Brass $9.10
Aluminum 4.50
Savings $4.60
Percent Savings 50.5%

Adjusting Screw
for "Immersion Aquastat"

Cost per 1,000 parts:
Brass $11.90
Aluminum 7.33
Savings .....$ 4.57
Percent Savings 38.5%

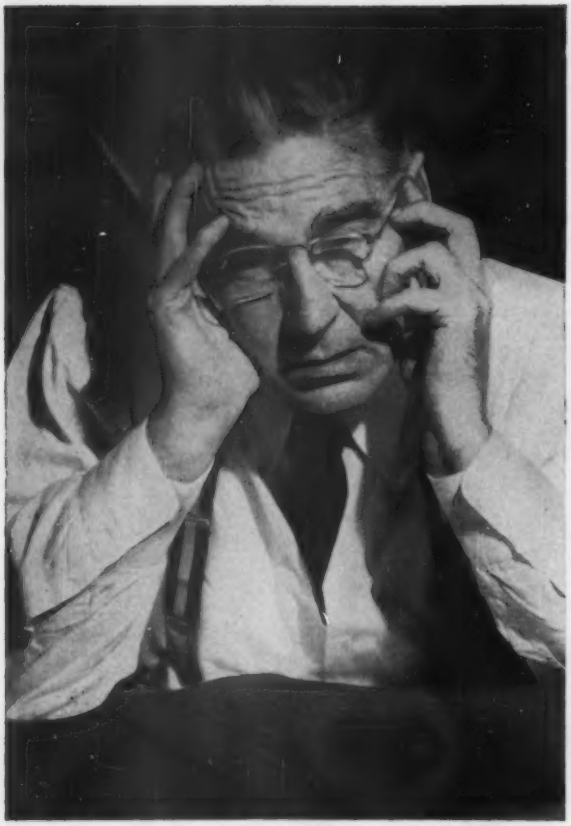
Packing Nut
for Temperature Controller Unit

Cost per 1,000 parts:
Brass $33.60
Aluminum 21.45
Savings $12.15
Percent Savings 36.2%

Recommended by Managements

Specified by Designers

Preferred by Operators



send it out to CDT

There is no faster, more reliable way to get help with difficult tooling problems than to send it to Columbus Die-Tool. Backed by 50 years of experience, CDT has three basic objectives when designing and building tools, jigs, fixtures or special machinery.

1. Increase Production
2. Improve Quality of Product
3. Lower Production Costs

These and other benefits are reasons why so many of the nation's leading manufacturers regularly avail themselves of the specialized services of Columbus Die-Tool. Perhaps we can solve your tooling problem and help you make your product . . . better, for less.

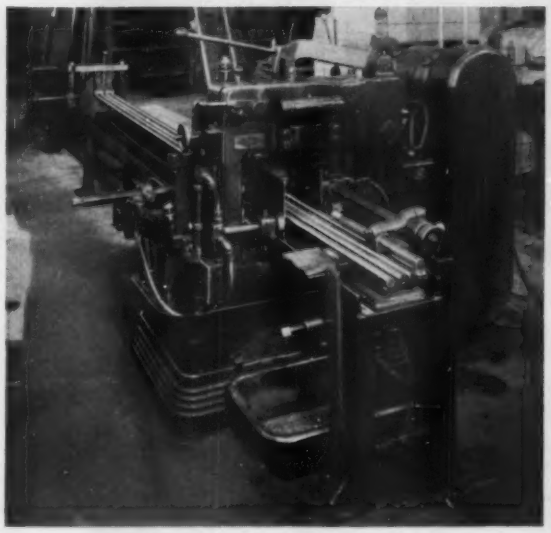
Columbus Die-Tool
AND MACHINE COMPANY

P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

Modine...

MAKES FINISHED CUTS FOR LESS THAN ½ CENT



WITH

PEERLESS

Mechani-Cut

The Modine Manufacturing Company has cut cost of sawing finished shafts for use in their unit heaters from approximately 5 cents each to 4 mills each—a saving of more than 4½ cents per cut by installing a 7" x 7" PEERLESS MECHANI-CUT SAW. Manufacturers throughout the country tell the same story of dramatic savings through the use of Peerless equipment.

Only the Mechani-Cut gives you the rigidity of a patented four-sided saw frame. This rigidity enables greater accuracy and faster cutting than any hack saw on the market today.

Consult your Peerless dealer on your metal cutting problem. Eighty Peerless sales engineers and dealers are located throughout the country.

For free literature on Peerless equipment write Dept. A.

PEERLESS MACHINE CO.

RACINE, WISCONSIN

*Controlled Measure

Just as the basic plans for a de-luxe shopping center or a super highway depends on surveyor's instruments for "controlled measure"

so does the precision of many important components depend on BATH GAGES for the "controlled measure" and smooth performance of the finished product.

When it comes to checking close tolerances in threaded and plain parts and holes — you can rely on Bath cylindrical plug or thread, ring and reversible gages for dependable inspection and long wear-life.

When you buy Bath Gages
*... you buy *"controlled measure".*

JOHN BATH & CO., Inc.
22 Grafton St., Worcester, Mass.
CYLINDRICAL AND THREAD GAGES · GROUND THREAD TAPS · INTERNAL MICROMETERS

ABC FAST SERVICE

YES SIR!

We specialize in *FAST* service when you need it.

Your orders are handled *FAST* at *ACCURATE.*

IMMEDIATE SHIPMENT

from huge inventory at our factory . . .

or from large stocks located in your area.

Special Sizes are given extra atten .on to be sure you get FAST service.

The next time you need drill bushings . . . *try ACCURATE!* You'll be pleased!

Write for New Price List — designed for quick, accurate reference

ACCURATE BUSHING COMPANY

440 North Avenue
GARWOOD, NEW JERSEY
SUnset 9-1121

ASA STANDARD DRILL BUSHINGS • PIERCING PUNCHES • PRECISION SPECIAL PARTS

For Better Knurling

NEW

KNURLMASTER
Hand Knurler
$13.50

No distortion — even on ⅛" stock! MODEL "C"

For small production runs on ⅛" to 1" stock. Exclusive screw design gives perfect knurl pattern. Furnished with 3 hardened knurls of standard ½" dia. Forged steel frame is self-centering. Write for illustrated folder.

DEALERS INQUIRIES INVITED

ROCKWIN MANUFACTURING CO.
80M Magnolia St., Westbury, L. I., N. Y.

They're tough, they're versatile
. . . and amazingly low in cost!

ACE
STUB DRILLS

The short, heavy duty flutes of Ace Stub Drills are ground into top quality pre-hardened high speed steel to give you keener cutting lips, extra strength, longer drill life. Ideal for close-to-work screw machine operations and portable drilling. And they're now stocked in 140 standard sizes that cost approximately 20% less than equivalent jobber length drills!

Call your local Ace Drill Distributor today!

NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

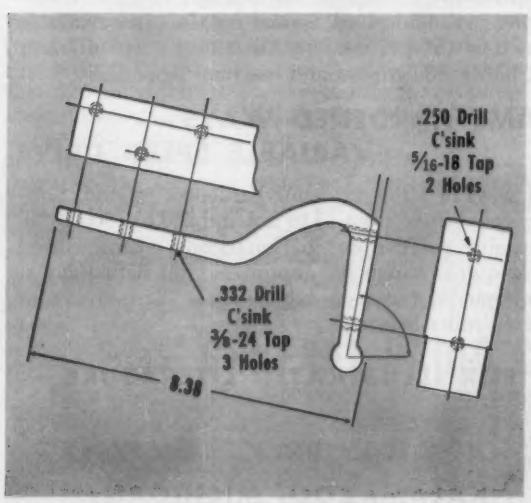
ACE DRILL
ADRIAN, MICHIGAN
ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

Two hinges drilled, countersunk and tapped every 11½ seconds ...automatically on a

KINGSBURY

Case Study 3929

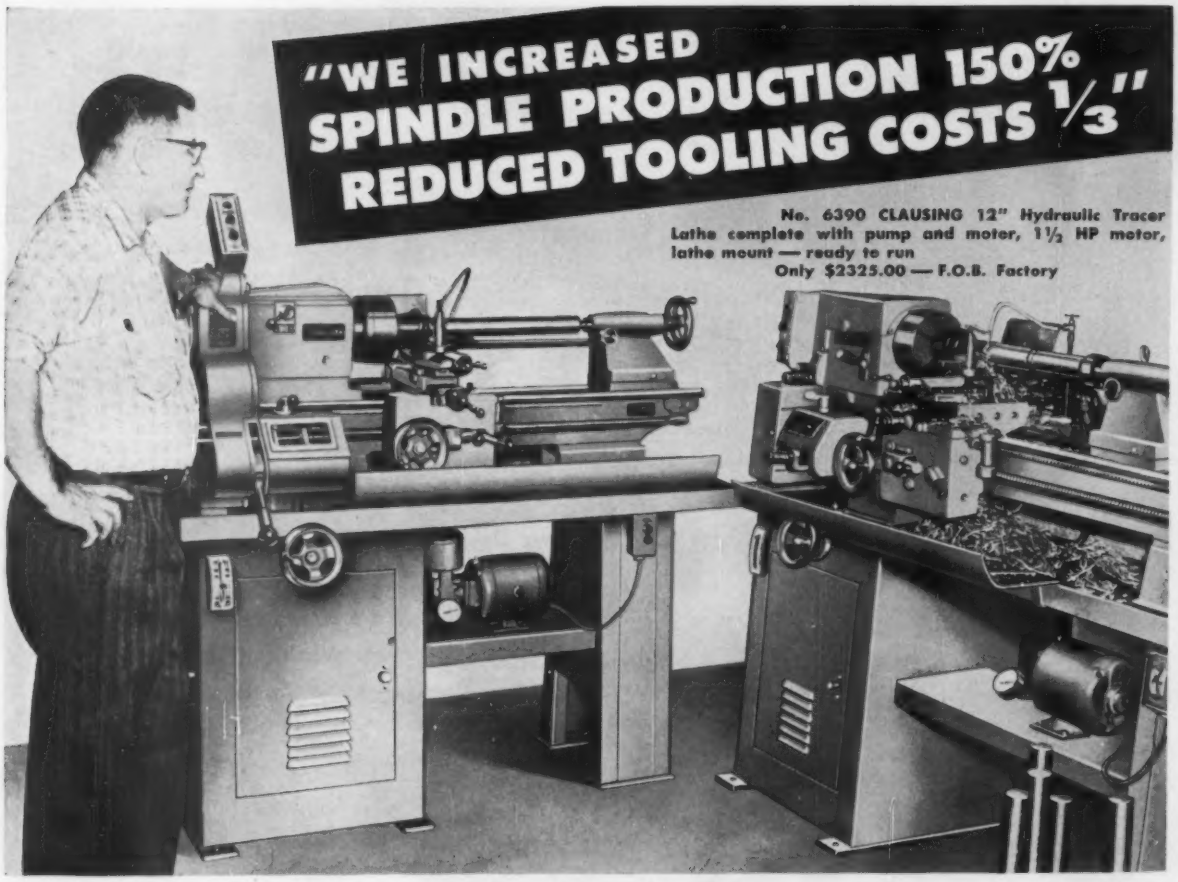
THREE OPERATIONS FROM TWO DIRECTIONS ON THIS FORGED STEEL HINGE ...620 PARTS PER HOUR GROSS



The print shows the angle at which the fixtures hold the work. This angle allows room for four vertical units (three visible in the photo). Each fixture holds two parts. The four vertical units drill half depth, drill through, countersink and tap three holes in each part. Two-step drilling shortens the time cycle and increases the production rate. Four angular units (only three visible in photo) perform similar operations on the two holes. The operator unloads a finished part, loads a rough one and pushes a button to index the table. After the table indexes, all units operate automatically.

All Kingsbury machines are completely tooled and ready to produce. We run test samples and ship them to you for your approval before we ship the machine. For high production drilling and tapping, a Kingsbury is the best machine you can buy. May we talk to you about your jobs?
Kingsbury Machine Tool Corporation, Keene, N. H.

KINGSBURY
INDEXING AUTOMATICS
for high production drilling and tapping


"WE INCREASED SPINDLE PRODUCTION 150% REDUCED TOOLING COSTS 1/3"
No. 6390 CLAUSING 12" Hydraulic Tracer Lathe complete with pump and motor, 1½ HP motor, lathe mount — ready to run
Only $2325.00 — F.O.B. Factory

NEW CLAUSING 12" HYDRAULIC TRACER LATHES

provide automatic duplicating of multiple diameters, tapers, bevels, shoulders, radii, grooves, chamfers.

The new Clausing 12" Hydraulic Tracer Lathe provides automatic reproduction, reducing to hours jobs that would otherwise require weeks or days. With this new CLAUSING you can . . . do automatic reproduction of intricate patterns • eliminate repetitive measurements, multiple tool set-ups, expensive forming tools • impart a smooth, stepless finish • provide automatic sizing • reduce chance for human error • practically eliminate scrap.

FOR SHORT RUN AS WELL AS VOLUME PRODUCTION – short runs can be done economically because set-up and tool changes can be made in minutes. Savings on long runs are phenomenal.

HANDLES WORK up to 12" diameter, 2½" diameter differential, 18" length. Hydraulic cylinder housed in Servo motor provides power to firmly drive and hold cutting tool. Slide feed, in and out, infinitely variable from 0 to 15" per minute. All critical parts of tracer unit hardened, ground and machine lapped.

FLAME HARDENED WAYS — VARIABLE SPEED DRIVE

Bed ways of lathe are flame hardened, ground. Variable speed drive from 43 to 222 and 250 to 1300 RPM, adjustable while running. Completely enclosed head stock, quick-change box, apron . . . oil bath lubrication. Spindle turns on big Timken "Zero-Precision" tapered roller bearings.

Write FOR ILLUSTRATED LITERATURE

Atlas CLAUSING PRECISION MACHINE TOOLS — DIVISION ATLAS PRESS COMPANY

CLAUSING DIVISION ATLAS PRESS COMPANY

2-101 N. PITCHER ST., KALAMAZOO, MICHIGAN

Photo Courtesy of Brown Instruments Division
Minneapolis-Honeywell Regulator Company

Reduce Product Noise ... and Improve Your Sales

ElectroniK instruments, manufactured by the Brown Instruments Division of Minneapolis-Honeywell Regulator Company, are widely used to monitor or permanently record changes in temperature, pressure, flow, speed, thickness and many other characteristics of industrial processes. Since a control room may contain many such recorders, the sound level per unit must be low to keep working conditions comfortable.

To evaluate the noise contribution of servo-motor bearings and gearing, the effects of motor mounting, and of other instrument construction features, Honeywell engineers carefully pretest all component parts for noise. The noise level of a given part is one more criterion determining whether that element is suitable for design into the product. To perform these tests, these engineers rely on the General Radio Sound-Measuring System . . . instruments and accessories for sound-level measurements, frequency analyses, and specialized work of all kinds. This equipment eliminates dependence on subjective auditory faculties of humans — they provide the conclusive data on which to base decisions and corrective measures.

Quiet operation is a virtue. If your product is not specifically engineered for efficient, noise-free operation, you are missing an important element of modern-day design. General Radio's complete and well-integrated line of sound-measuring instruments can help you improve your product sales appeal.

GENERAL RADIO Company

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8055 13th St., Silver Spring, Md. **WASHINGTON, D. C.** 1000 N. Seward St. **LOS ANGELES 38**

Up Against a Sound Barrier?

Type 1551-A Sound-Level Meter, $385

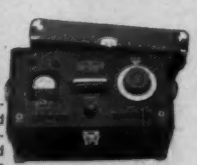
. . . basic tool of the G-R sound-measuring line . . . reads directly sound-pressure levels from 24 db to 140 db above standard A.S.A. reference level, and to 190 db with accessory high-level microphones . . . built-in weighting networks approximate the ear's response at various levels . . . internal calibration system permits convenient, rapid standardization . . . instrument is light in weight, dependable, compact, and completely self-contained.

Type 1555-A Sound-Survey Meter, $150

. . . highly popular instrument for preliminary investigations and consulting work where rapid surveying is needed to gauge magnitude of problem at hand . . . range is from 40 db to 136 db, three frequency characteristics are provided, and accuracy is within a few db of that of Type 1551-A . . . emphasis placed on small size, light weight, ease of use, reliability, and low cost.

Type 1550-A Octave-Band Noise Analyzer, $535

. . . for rapid, accurate broad-band analyses of sound energies widely distributed over the audio spectrum, as produced by shock excitation or turbulence . . . eight bands cover the frequency range from 20 to 10,000 cycles; each filter has excellent selectivity characteristics.



Type 760-B Sound Analyzer, $520

. . . for narrow-band measurements . . . best suited for analyzing noises of rotating, reciprocating, and other cyclic mechanisms where prevalent frequency components are harmonically related . . . direct reading over 25- to 7500-cycle range . . . bandwidth is 2% of selected frequency . . . instrument frequency response is flat within ±2 db over entire range.

Type 1556-A Impact-Noise Analyzer, $210

. . . measures three important characteristics, permitting determination of both level and duration of transients characteristic of impact noises . . . compact, portable instrument is first expressly designed for direct-reading measurements of impact noise.

Accessories Available For Sound-Level Meter

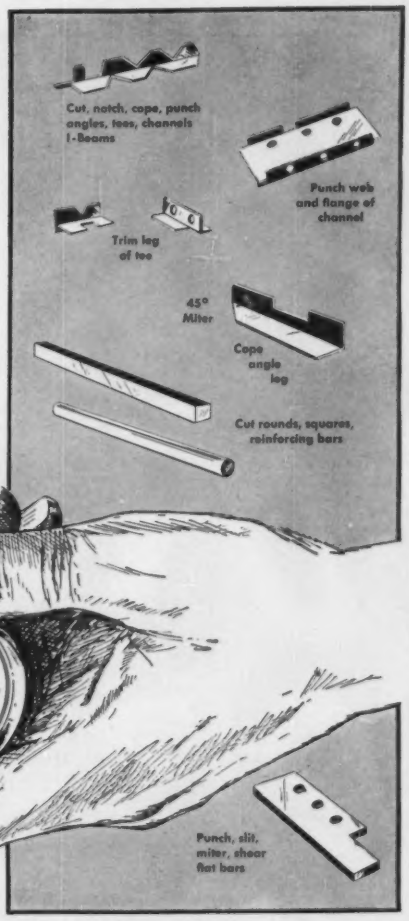
. . . Dynamic, Condenser, and High-Sound-Pressure Microphones . . . Vibration Pickup . . . Sound-Level Calibrator . . . External A-C Power Supply.

WE SELL DIRECT
Prices are net, FOB Cambridge or West Concord, Mass.

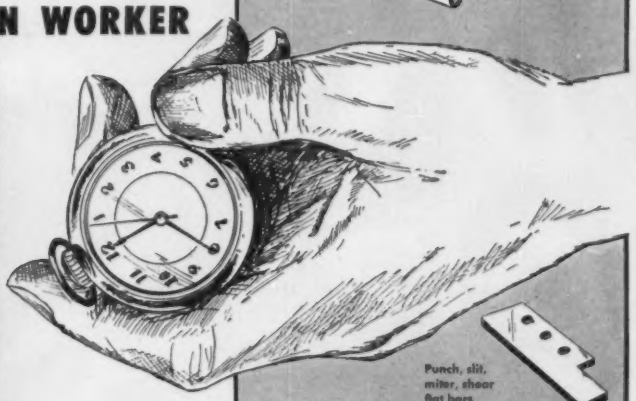
Write for Complete Information

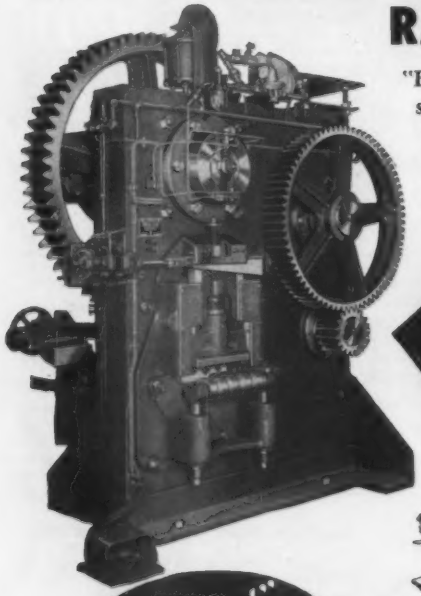
ALL THESE OPERATIONS ON ONE FAST MACHINE!

If your shop does two or more of the operations shown here, you'll be money ahead with a "Buffalo" Universal Iron Worker! Takes the space of one machine, does the work of six — two operations at once! No tool changes required. Built to take the strain and shock of your heaviest production or maintenance work, the frame is of rigid arc-welded heavy steel plate, and the one-shot lubrication system means minimum maintenance. Write for Bulletin 360 for details on the "Buffalo" Universal Iron Worker and its big brother, the "Buffalo" Unistructural Iron Worker for your heaviest structural work.


Cut, notch, cope, punch angles, tees, channels I-Beams
Punch web and flange of channel
Trim leg of tee
45° Miter
Cope angle leg
Cut rounds, squares, reinforcing bars
Punch, slit, miter, shear flat bars

"BUFFALO" UNIVERSAL IRON WORKER





RAPID, CLEAN BILLET SHEARING!

"Buffalo" Billet Shears are saving money for forging shops by their high-speed dividing of round and square billets with clean, square cuts. Because the "shearing" is actually a straight *fracture*, there is no "smearing" to conceal possible porosity, as with burning or sawing — resulting in better inspection. 11 sizes to handle up to 10" rounds and 9" squares at 6 strokes per minute — correspondingly higher speeds in the smaller sizes.

Write today for Bulletin 3295-C.

"BUFFALO" BILLET SHEARS

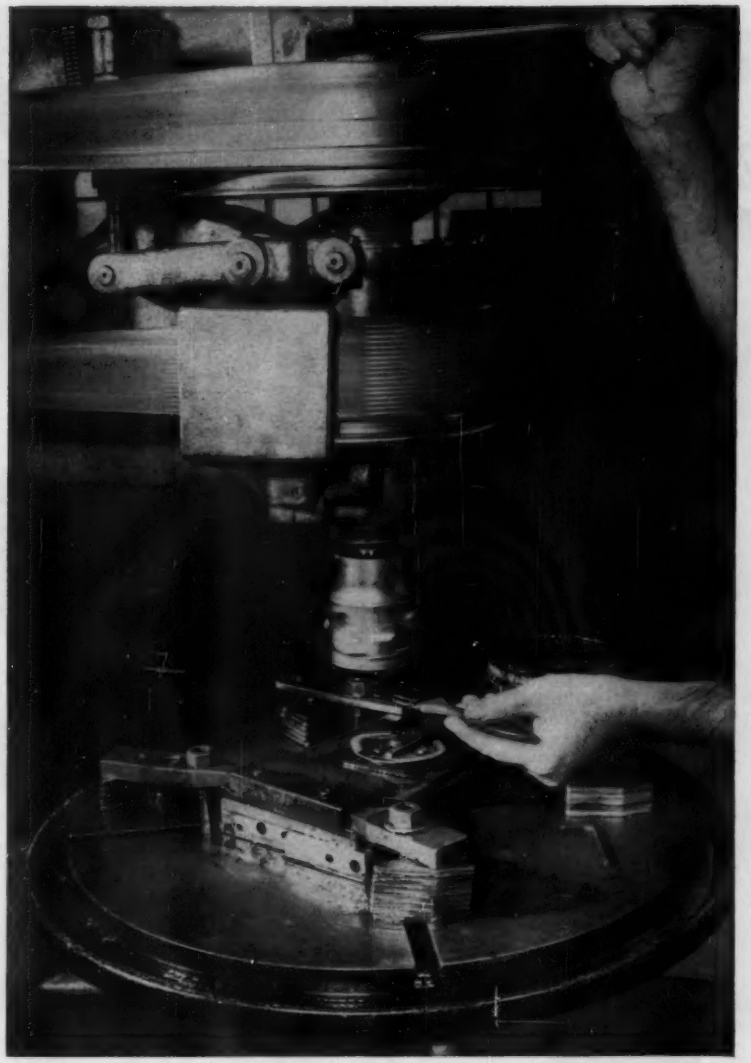
BUFFALO FORGE COMPANY

509 BROADWAY, BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

"INCREASED TAP LIFE FROM 250 TO 4000 PIECES"



Cities Service Chillo Cutting Oil produces astounding results for C.S.S. Machine & Tool Company, Philadelphia, Pa.

Metal stamping . . . precision grinding . . . machining . . . stud welding . . . tool and die making. These are some of the expert operations performed by the 120 skilled employees of C.S.S. Machine & Tool Company of Philadelphia . . . operations based on many years' knowhow and teamwork. And for the past year, with Cities Service cutting fluids, this work has been done with even greater precision, greater efficiency than ever before.

In its tapping operation, for example, C.S.S. increased tap life from an average 250 pieces to over 4000 pieces with Cities Service Chillo Cutting Oil. And in a drilling operation with its Brown and Sharpe Automatics, time required to make one piece was cut from 240 to 165 seconds!

Says President F. G. Schutz: "Cities Service Chillo Cutting Oils are the best we've ever seen. Likewise, Cities Service Lubrication Engineers. It's wonderful to deal with someone who knows our operation so well and has products that help improve it."

If you have a lubrication problem, or even if you're running smoothly, talk with a Cities Service Lubrication Engineer. He's known for solving problems, known for making smooth operations still smoother. Or, if you prefer, write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

ALL THESE OPERATIONS ON ONE FAST MACHINE!

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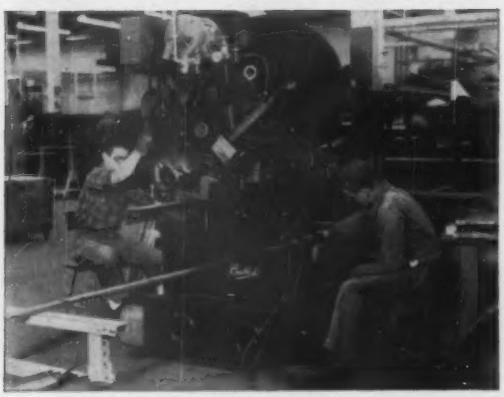
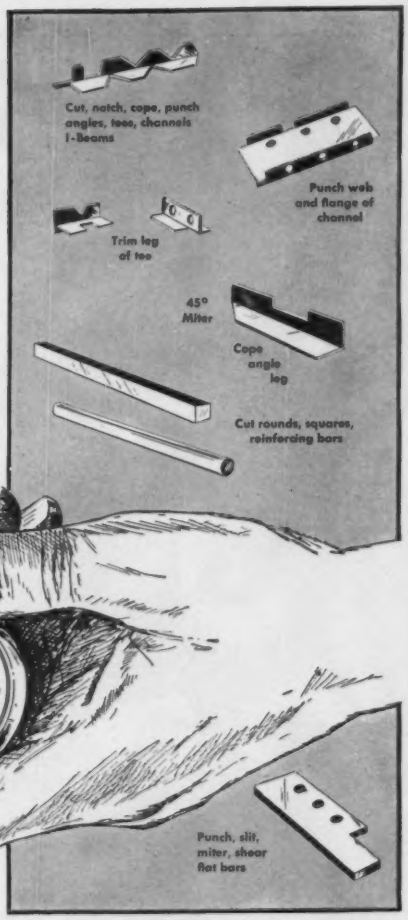
"BUFFALO" UNIVERSAL IRON WORKER

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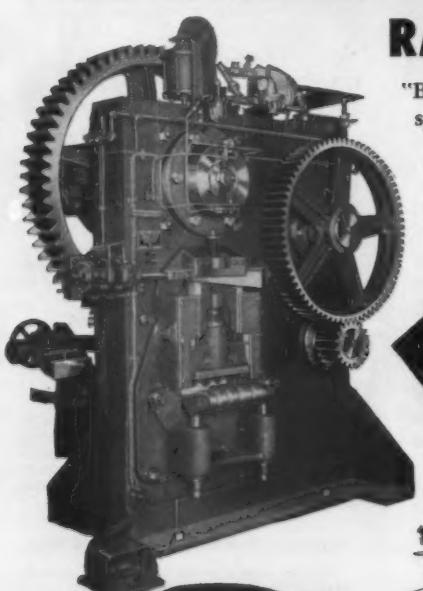

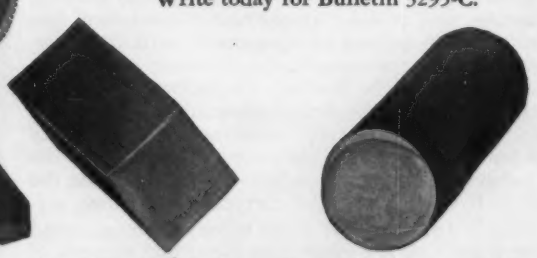

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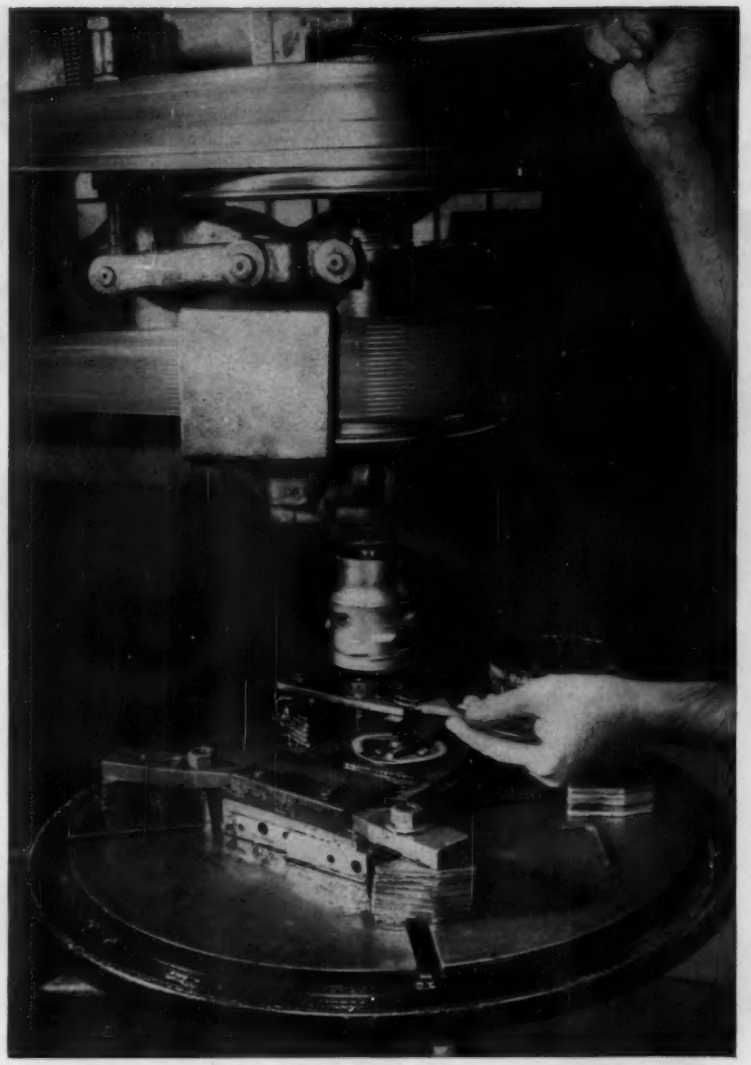

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CITIES SERVICE

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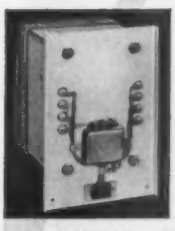
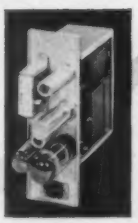
And now . . . . . STANDARD SYSTEMS FOR YOUR MACHINE TOOLS TO GIVE

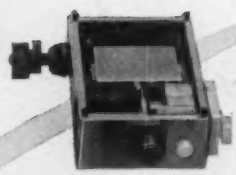
Automatic Size Control



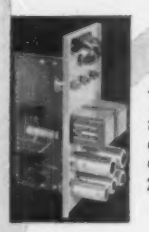
MAGNETIC POWER AMPLIFIER — provides power amplification to pre-amplifier output sufficient to drive servo motor. Various sizes required for various motor sizes.



ELECTRONIC POWER SUPPLY — regulated, supplies, pre-amplifier and classifier circuits.

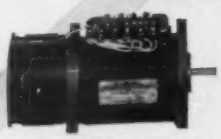


TRANSDUCER HEAD —comparator type, gives output proportional to size deviation from zero setting.



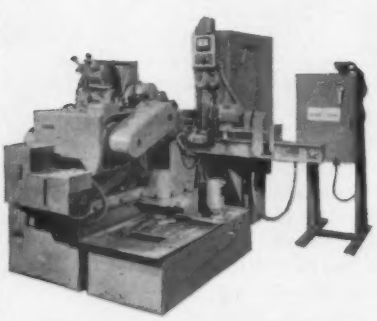
ELECTRONIC PRE-AMPLIFIER — feedback stabilized, amplifies transducer output to operate classifier circuits, size indicator, and power amplifier.

ELECTRONIC CLASSIFIERS — adjustable under - and over - size limits. Used for operating automatic reject gates, warning lights, automatic machine shutoff.



SERVO MOTORS — two phase induction type. Size chosen to fit applications. May include tachometer feedback for rate servo applications.

SIZE INDICATOR— meter type. Available with several ranges of full scale reading from .0005 to 0.1 inches.



Cargill Detroit components add automatic size control to this through feed centerless grinder.

COMBINATIONS of these standard components (illustrated) will equip your machines with

automatic size control

and automatic gaging

Components can also be grouped to provide automatic inspection and classifying.

All seven of these components have been developed by machinery builders for machinery applications.

All seven have been proved by production use in heavy industry.

HOW TO OBTAIN

Cargill Detroit engineers will specify complete systems to meet your specific machine requirements. Tell us your problem, and we will submit an engineering appraisal.

CARGILL · DETROIT *Corporation*

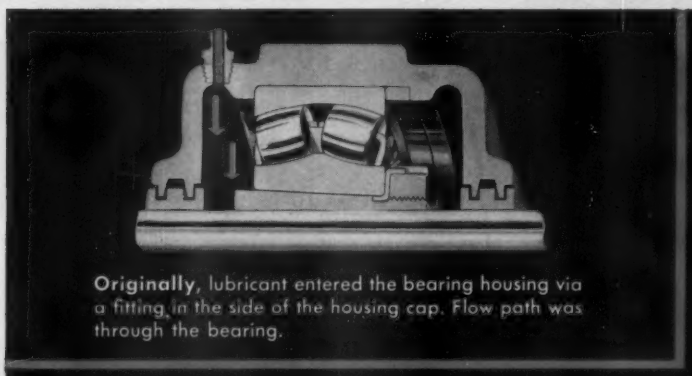
2254 Cole Avenue Birmingham, Michigan

Designers and Builders of Automatic Manufacturing

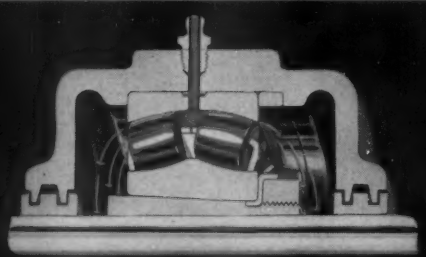
Established in 1949

At No Extra Charge ... A MAJOR IMPROVEMENT

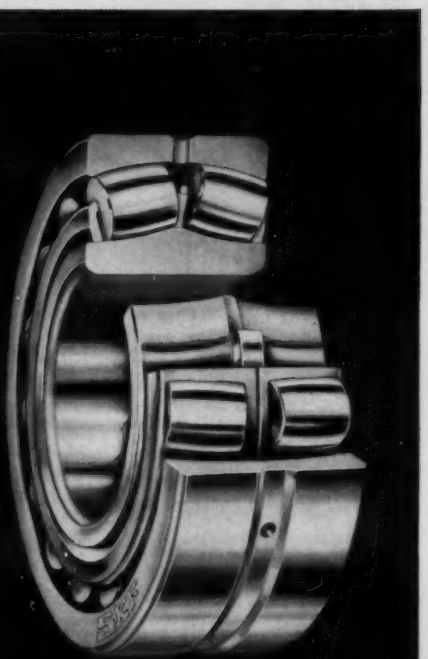
IN LUBRICATING SPHERICAL ROLLER BEARINGS



Originally, lubricant entered the bearing housing via a fitting in the side of the housing cap. Flow path was through the bearing.



NOW, the lubricant is introduced through a fitting in the center of the housing cap and moves along a groove that is machined around the circumference of the outer ring. Equally spaced holes drilled in the ring permit the lubricant to enter the center of the bearing.



Nobody but SKF Offers This to You on Spherical Roller Bearings

Once again **SKF** offers another important innovation in spherical roller bearing design. Available in spherical roller bearings 140 mm (5.5118") O.D. and larger, this feature represents a still further improvement to the proven **SKF** Type "C" Spherical Roller Bearing.

The new design allows the lubricant to enter at the *center* of the bearing and move outwardly – completely covering all working surfaces. Old lubricant is flushed away from the bearing and, with it, any abrasive dust, dirt, moisture, or other impurities.

You can use this improved bearing in your existing housings simply by moving the lubrication fitting to the center.

Here again is an example of how **SKF** helps you to obtain longer bearing life, at no added cost. Send for Bulletin No. 443 for complete details. 7751

SKF®

EVERY TYPE—EVERY USE

Ball Bearings
Cylindrical Roller Bearings
Spherical Roller Bearings
Tapered Roller Bearings ("Tyson")

*Reg. U.S. Pat. Off. Tyson Bearing Corporation

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

Let ETTCO help you plan on production drilling and tapping of small holes

. . . at a realistic investment!

Ettco-Emrick

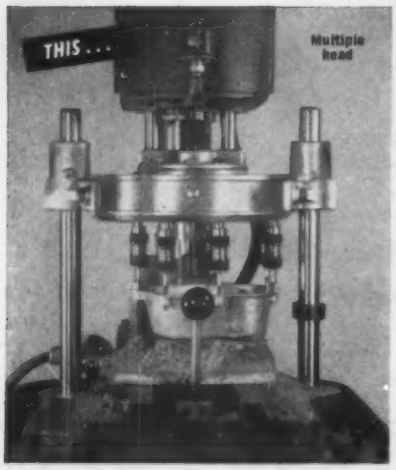
The only full line manufacturer of drilling and tapping equipment covering the entire small hole field

If you've discarded the idea of multiple drilling and tapping small holes because of heavy initial investment, that's another reason why it pays to plan with Ettco.

Ettco-Emrick equipment is built of standardized "Unit-Engineered" parts and *fewer* parts – most of which are interchangeable and reuseable for many other jobs.

And since Ettco concentrates solely on the manufacture of small hole equipment, you can be sure the unit or machine recommended is *exactly* suited to the job; highly efficient, yet never expensively over-powered – thus realistically priced.

Let's prove it! Send us a sample part and background information on your production requirements and we'll report immediately. Ask for our catalog, too. It's quite helpful and informative.



See these few examples of Ettco drill & tap planning

These pictures are typical of Ettco-Emrick "Unit-Engineering." Standard multiple heads and work holding fixtures as well as the famous "Twins" can easily be assembled in any combination to make fast, high production special drilling and tapping machines at realistic prices to suit your small hole needs. The "Twins" may be used separately or in unlimited combination – single spindle or with multiple heads as required.

Authorized Ettco distributors are ready to serve you throughout the U.S. and Canada

Ettco-Emrick

ETTCO TOOL & MACHINE CO., INC.

590 Johnson Avenue, Brooklyn 37, N. Y.

Chicago • Detroit • Los Angeles • Indianapolis

TAPPING ATTACHMENTS • MULTIPLE HEADS • DRILLING & TAPPING UNITS AND MACHINES
SPECIAL MACHINES • INDEXING FIXTURES • TAP & DRILL CHUCKS

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

New Equipment, With Die of Lehigh H, Ups Production of Cabinet Parts 200 Pct

The F. H. Lawson Co., Cincinnati, maker of bathroom cabinets, recently increased production of body blanks about 200 pct by installing a high-speed notching and cut-off operation, which is automatic from the coil to the body blank. It includes a 20-piece die, made of Bethlehem Lehigh H tool steel which had been supplied by Solar Steel Corp., Cincinnati.

In the new setup, a decoiler pulls 20-gage steel stock through the stretcher leveler into the Lehigh H die, where it is notched and blanked at about 50 strokes per minute. The die, hardened to Rockwell C 61, passed its first five months of service without any need for redressing.

Lehigh H is an ideal tool steel for blanking jobs and other severe applications, because of its wear- and shock-resistance, plus its high compressive strength. Lehigh H is our special-purpose high-carbon, high-chromium grade of air-hardening tool steel.

TYPICAL ANALYSIS

Carbon 1.55	Molybdenum 0.80
Chromium 11.50	Vanadium 0.40

There's probably more than one application in your shop where Lehigh H tool steel could do a real job. Why not try it? All you need do is get in touch with your local Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Grinding Cracks Not Always Fault of Grinder

As a rule the grinding cracks which sometimes appear during the finish-grinding of hardened tools are attributed to improper grinding practice. They can be caused by:

1. Scorching by removing metal too rapidly.
2. Dull or loaded grinding wheel.
3. Too fine a grit size.
4. Ineffective use of coolant.

But grinding technique is not always to blame. For example, a tool which has not been adequately tempered after quenching, or one that has become embrittled by an excessively high quenching temperature, may be impossible to grind without cracking, regardless of the care used in grinding.

Unless the cause of the cracking is obvious, we recommend a complete investigation. Once the source of the trouble is known, it's easy to specify the cure.

CARBON WATER-HARDENING ECONOMICAL IN HEADING DIE STEEL

This heading die is being finish-ground prior to manufacture of $\frac{5}{8}$-in. diam button-head track bolts. Hardened to Rockwell C 60, and working on C 1016 steel, it can produce about 100,000 pieces between grinds. Bethlehem Carbon Water-Hardening steel has high shock-resistance, and its controlled carbon range gives it ability to withstand the effects of wear and cold-battering. When used in cold-heading applications, the correct degree of hardenability must be supplied.

A Multipress case study

Small lot production of intricate electronic parts is performed quickly and economically on this Denison hydraulic Multipress.

MULTIPRESS® speeds electronic parts assembly at General Radio

The Problem: Planning a production set-up for a company that averages a new, complex electronic instrument every month, in production lots ranging from 50 to 100,000 units.

The solution: Denison's versatile hydraulic Multipress.

General Radio Company of Cambridge, Mass., a leading designer and manufacturer of electronic test equipment, finds Multipress capable of automatic operations on volume runs, yet efficient when manually operated for small lots.

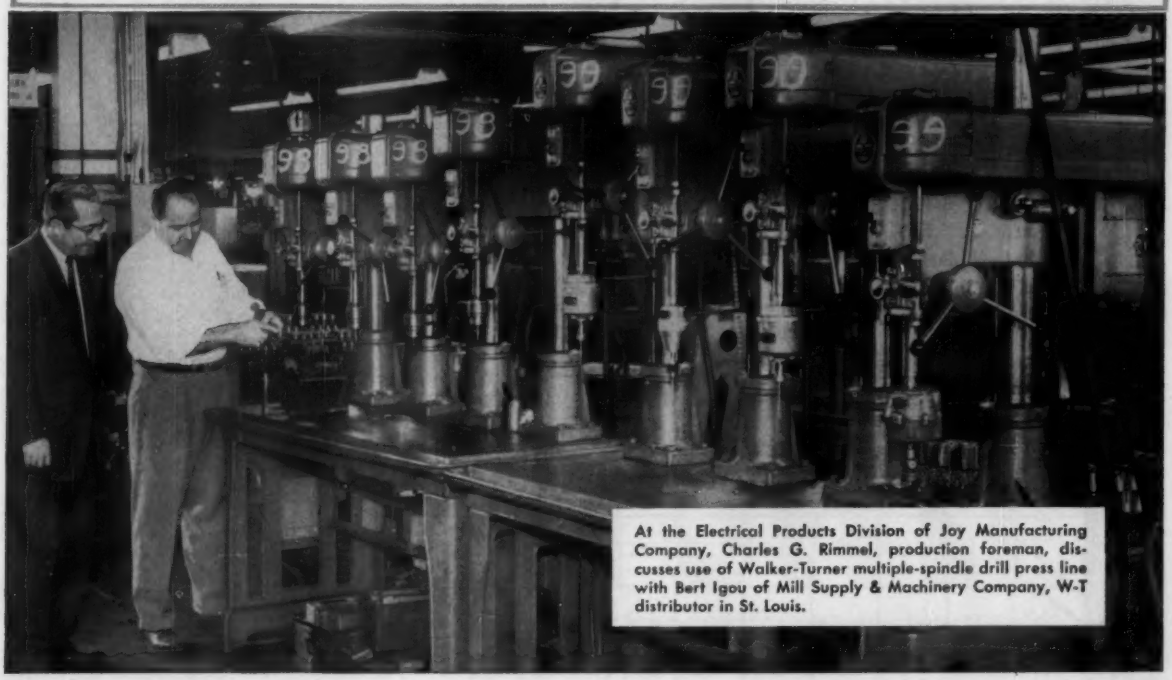
Small lot production costs have been reduced substantially. Operator safety is at peak levels. Smooth, precise pressure control produces uniform assemblies despite thickness variations in stock materials.

These Multipress benefits are typical. To find out how Denison hydraulic power can lower costs, speed production and improve quality for your company, consult a Denison hydraulic specialist. Write Denison Engineering Division, American Brake Shoe Co., 1164 Dublin Road, Columbus 16, Ohio.

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

INDUSTRY REPORTS ON W-T WALKER-TURNER



At the Electrical Products Division of Joy Manufacturing Company, Charles G. Rimmel, production foreman, discusses use of Walker-Turner multiple-spindle drill press line with Bert Igou of Mill Supply & Machinery Company, W-T distributor in St. Louis.

The Electrical Products Division of

Joy Manufacturing Co. reduces machining costs by using W-T Drill Presses in place of larger, expensive equipment

Operator end-drilling contacts at Joy St. Louis plant with 20" Walker-Turner drill press. Output per shift averages 2,400 to 2,500 contacts per spindle.

The Electrical Products Division of Joy Manufacturing Company, St. Louis, Mo., manufacturers of electrical connectors, purchased one Walker-Turner 20" drill press several years ago. Results were so satisfactory that the company now has 15 units—13 on the production line and 2 in the toolroom.

Of particular note is the company's use of two Walker-Turner four-spindle drill presses (as shown above) for end-drilling and chamfering contacts. Now this work is being done faster and at less cost than with the larger, expensive machinery formerly used.

Plant manager Gilligan and production foreman Rimmel have this to say about the performance of W-T presses. "Their slightly higher initial cost over competitive equipment has been more than offset by the high quality of work produced and the fact that we have had no maintenance problems with the presses."

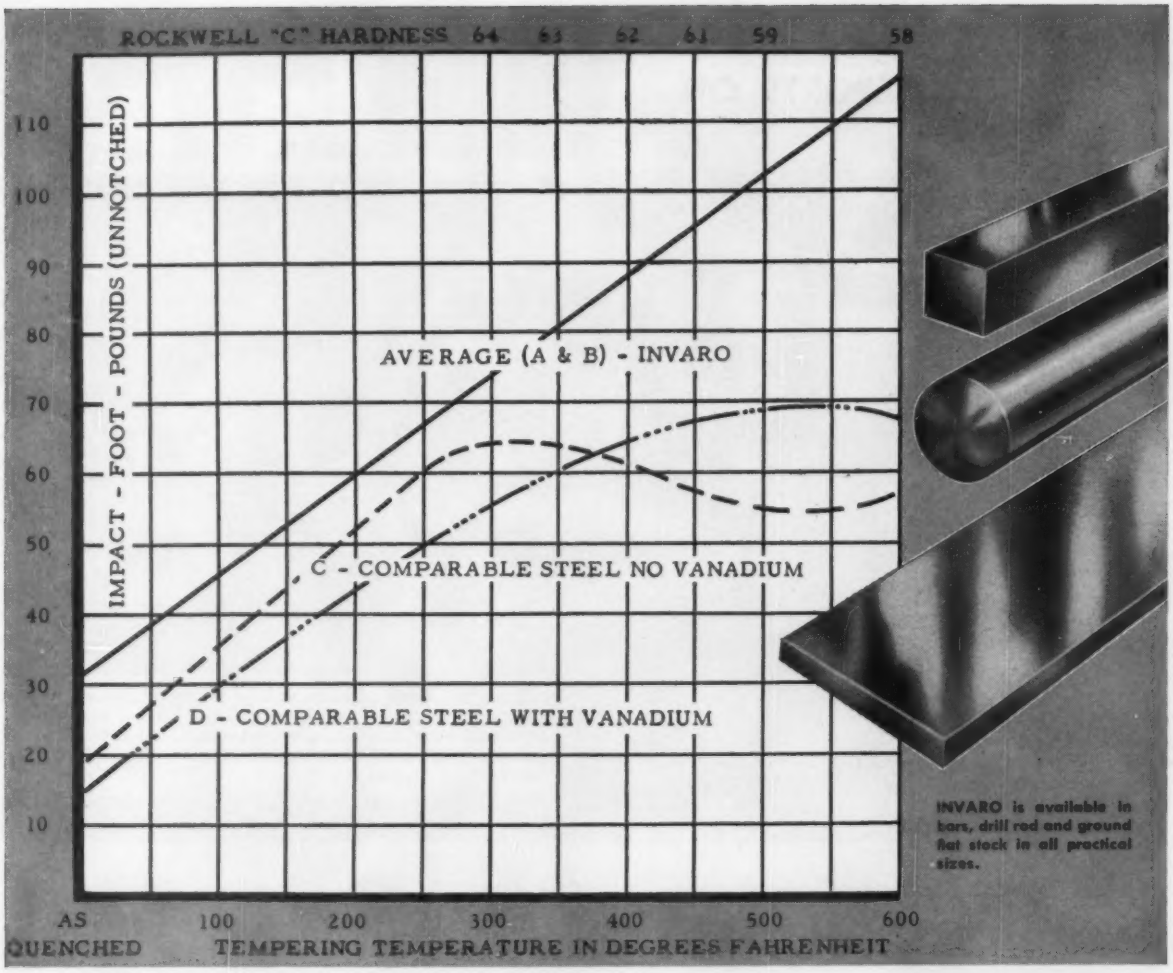
Ask your W-T distributor to demonstrate what Walker-Turner "Light-Heavyweight" machine tools can do for you. He's listed under "Tools" in your telephone book. Or mail the coupon below for details.

walker-Turner

WALKER-TURNER
Division of Rockwell Manufacturing Co.
Dept. WB-21, 400 N. Lexington Ave., Pittsburgh 8, Pa.

☐ Please send name of my Walker-Turner distributor.
☐ Please send literature on Walker-Turner drill presses.

Name_____
Address_____
City_____ Zone____ State_____



INVARO . . . *IZOD-PROVED* THE TOUGHEST

of leading comparable oil-hardening tool and die steels

When the toughness of a tool and die steel is the critical factor of selection, Firth Sterling INVARO is the *tonghest* of the tough! That's not just an opinion but a *fact.* Undeniable proof is established by the A.S.T.M. Izod Impact Test, results of which are graphically shown above, comparing steels both with and without vanadium.

INVARO shows a superior toughness in *all* ranges of temperature from a minimum advantage of about 12% to as much as 100% greater! This marked superiority is the result of Firth Sterling's advanced metallurgical practices combined with 67 years of experience in the art of making specialty steels.

Yes, when you want *toughness* in your tools and dies, combined with uniformity, excellent hardening properties and safety in heat treating . . . specify INVARO.

Chemical Analysis	*All test samples were machined from half-inch annealed bar stock.* C	Si	Mn	S	P	W	V	Cr
Invaro A	.88	.34	1.22	.010	.020	.49	.19	.50
Invaro B	.94	.25	1.20	.014	.013	.53	.22	.49
Comp. C	.90	.33	1.24	.011	.025	.50	—	.55
Comp. D	.95	.34	1.27	.010	.020	.50	.21	.59

Firth Sterling

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

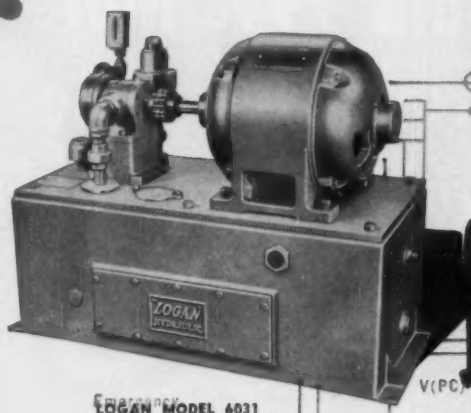
MILLS: McKEESPORT, TRAFFORD, DETROIT, HOUSTON, HARTFORD

OFFICES AND WAREHOUSES*: BIRMINGHAM CHICAGO* CLEVELAND* DAYTON DETROIT* HARTFORD* HOUSTON* LOS ANGELES* PITTSBURGH WESTFIELD, N.J

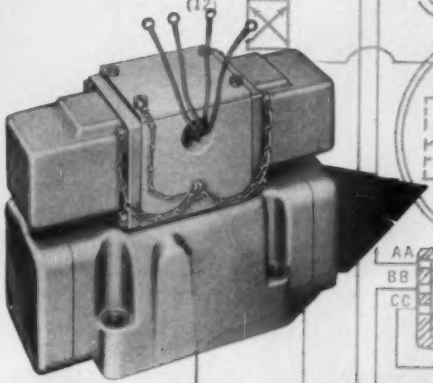
R-320

PRODUCTS OF FIRTH STERLING METALLURGY

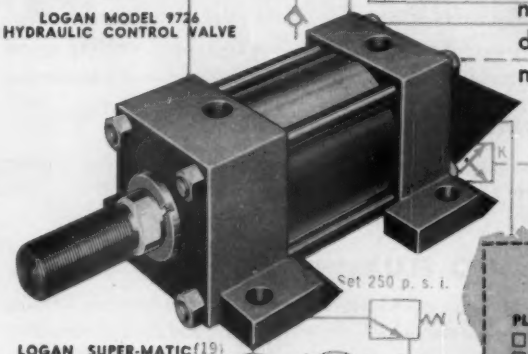
High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium



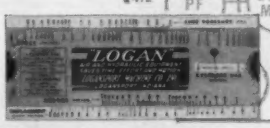
LOGAN MODEL 6031
HYDRAULIC POWER UNIT



LOGAN MODEL 9726
HYDRAULIC CONTROL VALVE



LOGAN SUPER-MATIC
HYDRAULIC CYLINDER



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FOR POSITIVE, CONTROLLED

POWER

For the simplest or the most complex circuit design . . . Look to Logan. Your one-source manufacturer of dependable hydraulic components to meet your particular need. The assistance of Logan's capable engineering staff is at your service to help you design the circuits to most effectively meet your production problems.

MEMBER: Natl. Mach. Tool Builders' Assn.; Natl. Fluid Power Assn.

FREE! *Send for the "Logan Calculator"*

Properly designed, properly equipped by Logan.

LOGANSPORT MACHINE CO., INC.
818 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ 100-1 AIR CYLINDERS
- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-5-1 ULTRAMATION CYLINDERS
- ☐ 51 PRESSES
- ☐ FACTS OF LIFE
- ☐ 62 SURE-FLOW PUMPS
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
- ☐ 200-3 750 SERIES HYD. CYLINDERS
- ☐ 200-4 and 200-7 HYD. VALVES
- ☐ 200-6 SUPER-MATIC CYLS.
- ☐ 70-1 CHUCKS
- ☐ ABC BOOKLET
- ☐ CIRCUIT RIDER

TO:

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

Steel gussets, ⅝-in. thick are sigma welded to ½-in. thick drum ends at an average speed of 15-in. per minute.

This welding operator doesn't have to bother with fluxes—and he doesn't lose valuable time changing burned down electrodes. In fact, by using sigma welding in this operation, the Cardwell Manufacturing Company, Wichita, Kansas has increased welding speed and almost doubled arc time. The results—a better product, faster, and at less cost.

AUTOMATIC WIRE FEED

Sigma welding uses a welding wire, supplied from a convenient sized coil, as a consumable electrode. In this case it is stainless steel wire which is fed automatically, and at a predetermined rate, into the welding arc. This ups welding speeds and simplifies work.

NO FLUX

The arc is maintained in a shield of argon gas which envelopes the area between welding wire and work piece. Inert gas protection assures highest weld quality, and further simplifies welding operations.

Sigma welding is available in both manual and mechanized setups. Call or write your local LINDE representative for free illustrated literature, and find out how you can gain new production speed and unit quality with a sigma welding installation.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: LINDE AIR PRODUCTS COMPANY
Division of Union Carbide Canada Limited, Toronto

Linde
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The term "Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.

Speed Inspection
OF PRODUCTION PARTS!

NEW **DEARBORNAIRE**

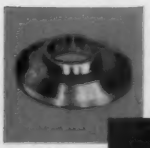
MULTIPLE COLUMN AIR GAGING INSTRUMENTS

To speed inspection of production parts, new Dearbornaire air gaging instruments are now offered in multiple column units designed to permit more accurate simultaneous checking of as many dimensions as may be required for a given part. What's more, each unit incorporates all of the advanced design features which have made Dearbornaire the most practical, most versatile column type instrument ever produced . . .

- New higher rated pressure system and built-in circuit restrictions make them virtually self-cleaning, reduce maintenance to a minimum.
- New glass tube has a characterized internal taper which provides positive linear accuracy over the full extent of the calibrated scales.
- Easy-to-read Zero-centered scales permit use of instrument for normal inspection, statistical quality control, and as a tool setting gage.
- Interchangeability of component parts simplifies conversion from one amplification to another, reduces spare parts inventory costs.

Plus a complete line of air gage spindles, rings, snaps and cartridges all precision finished to give you greater accuracy, longer wear life. Free demonstration arranged upon request. Write for details today!

Special Air Gaging Fixtures designed and built to meet your particular application requirements. Complete engineering service available upon request.



Send part print showing all dimensions to be checked and tolerances required for prompt quotation and delivery.

AIR GAGE DIVISION
DEARBORN GAGE COMPANY
22038 Beech Street • Dearborn, Michigan

118 feet of automation—

performs machine operations on bank surfaces, valve lifter holes and distributor hole of V-8 engine block.

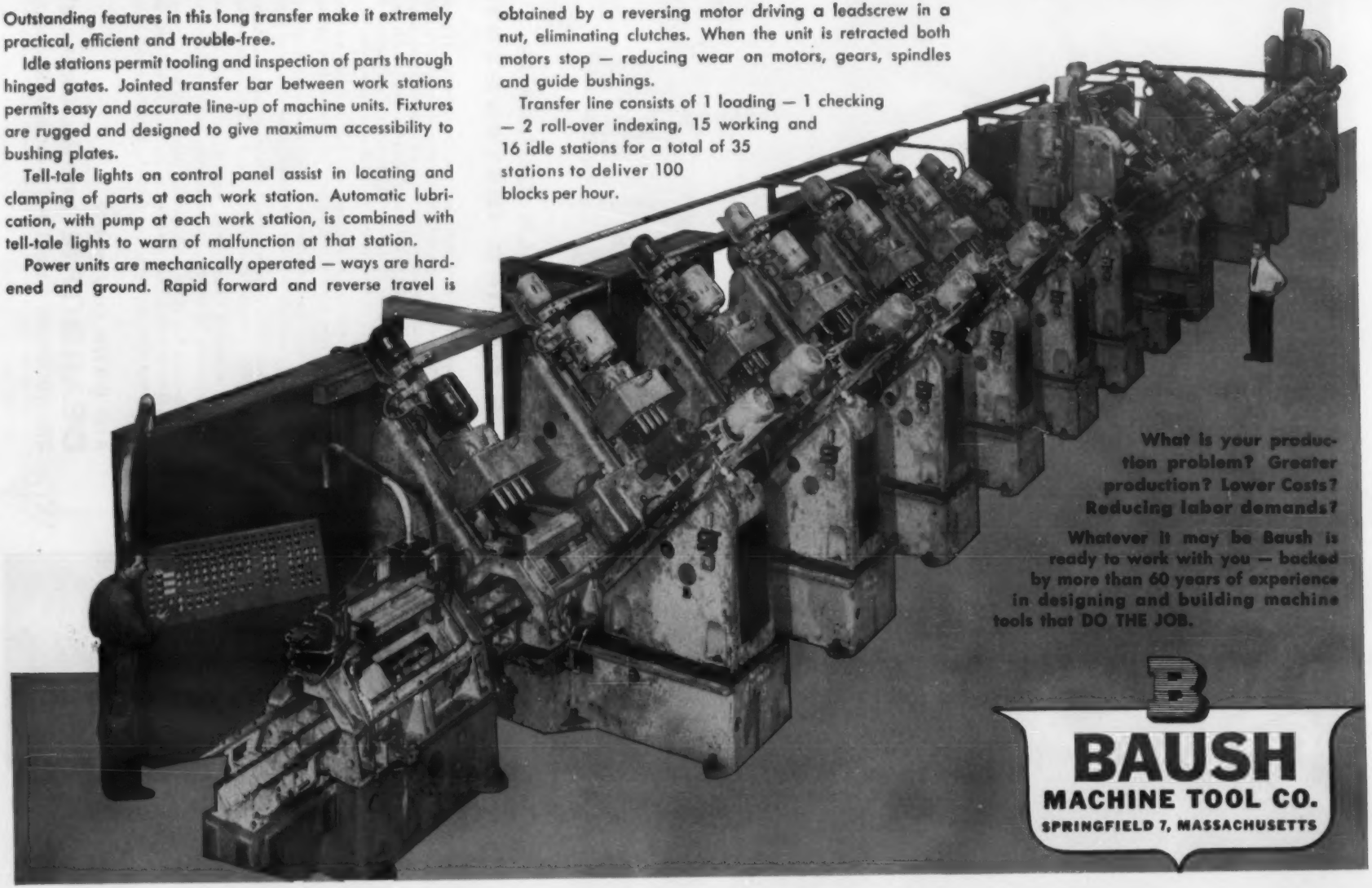
Outstanding features in this long transfer make it extremely practical, efficient and trouble-free.

Idle stations permit tooling and inspection of parts through hinged gates. Jointed transfer bar between work stations permits easy and accurate line-up of machine units. Fixtures are rugged and designed to give maximum accessibility to bushing plates.

Tell-tale lights on control panel assist in locating and clamping of parts at each work station. Automatic lubrication, with pump at each work station, is combined with tell-tale lights to warn of malfunction at that station.

Power units are mechanically operated — ways are hardened and ground. Rapid forward and reverse travel is obtained by a reversing motor driving a leadscrew in a nut, eliminating clutches. When the unit is retracted both motors stop — reducing wear on motors, gears, spindles and guide bushings.

Transfer line consists of 1 loading — 1 checking — 2 roll-over indexing, 15 working and 16 idle stations for a total of 35 stations to deliver 100 blocks per hour.



What is your production problem? Greater production? Lower Costs? Reducing labor demands?

Whatever it may be Baush is ready to work with you — backed by more than 60 years of experience in designing and building machine tools that DO THE JOB.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

OSBORN BRUSHING METHODS worthy of your confidence

At the push of a button. *Osborn Master® Wheels remove burrs and blend surface junctures. Costs are down 74% from previous hand method.*

Push-button finish... 1400 per hour

THE manufacturer of this machined aluminum ammunition component was faced with the necessity for attaining a high production rate, and at the same time, meeting the standards of rigid quality control.

Working closely with the Osborn representative, he built the rotating fixture shown above. Three Osborn Master® Wheels quickly remove feather burrs, blend surface junctures. Uniformly finished parts come through at the rate of 1400 per hour.

Osborn offers its services to you without obligation. A qualified **O**sborn **B**rushing **A**nalyst is available wherever industry centers. He will welcome the opportunity to work with you. Write *The Osborn Manufacturing Company, Dept. C-54, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

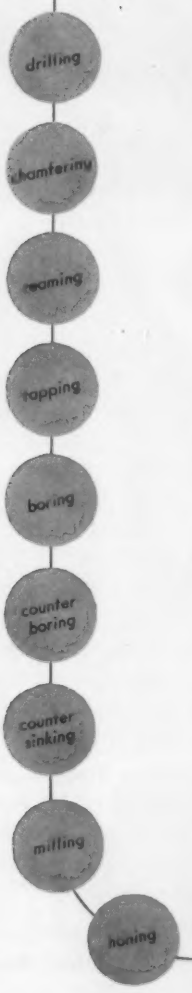
Write TODAY for the new 100-page Osborn Catalog 210-C.

Osborn Brushes

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

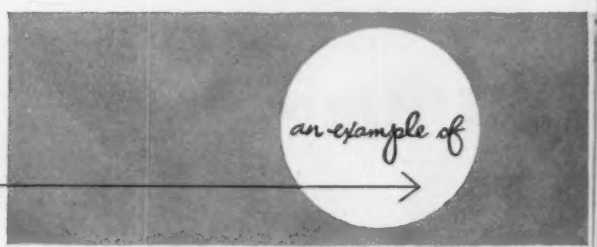
BARNESDRIL

complete automation | solves production problems



Whether it involves combining a series of machining operations into a single automatic cycle, combining a series of machines to meet production requirements or complete automation, BarnesdriL engineers can help you solve output problems to meet assembly needs. In the instance shown, a completely automatic machine was required to meet necessary demands for number of parts per hour and conveyor feed and carry-away production.

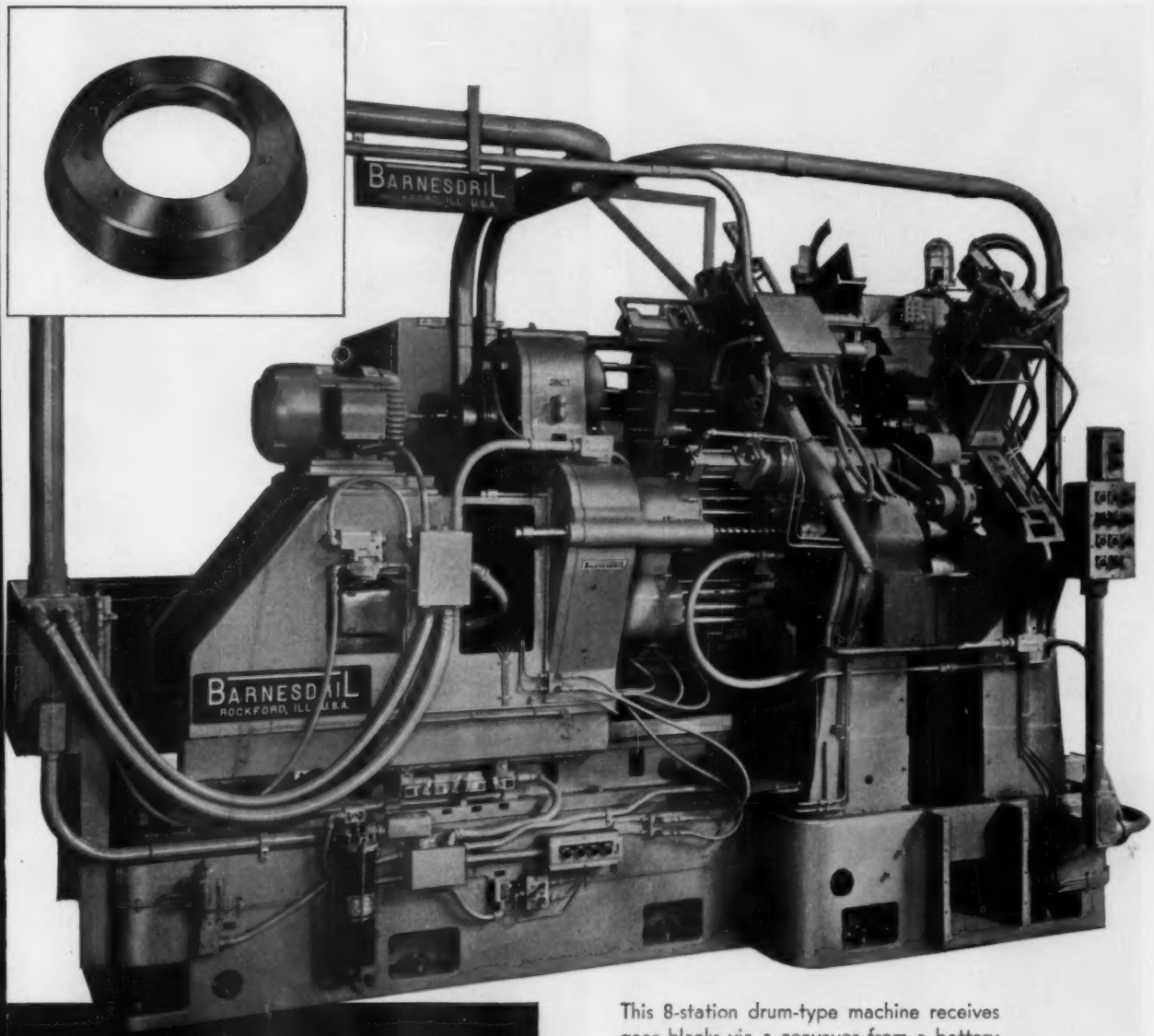
For 50 years BarnesdriL has been making hole producing and finishing machines to fit production schedules. If your requirements include any or all of the following operations — drilling, chamfering, reaming, tapping, boring, counterboring, countersinking, milling, honing — contact a BarnesdriL Factory Representative for specifications and production estimates on machines designed to hold your production schedule.



50th year

BARNES DRILL CO.

830 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 3419 South Telegraph Road



complete automation
designed and built by
BARNESDRIL

This 8-station drum-type machine receives gear blanks via a conveyor from a battery of lathes. The machine automatically loads itself, clamps and indexes the blanks through 7 separate stations. At the various stations the gear blanks are drilled, chips are blown out, holes gauged and probed, then chamfered, reamed and tapped. The blanks are then unclamped and automatically loaded onto another conveyor which carries the blanks to successive operations. If inadequate depth of holes, or broken tools, are detected at the probing station, the machine automatically stops and a red light appears on top of the machine. The machining cycle is resumed only after the part has been removed from the reject chute and proper tool adjustments have been made.

This is one of four such machines turning out over 800 parts per hour at 80% efficiency.

"GEIGER COUNTER for $98.50 caused buying rushes and regular use of Air Express," says the President of The Detectron Corp., J. L. Cassingham.

"GUIDED MISSILE PARTS always meet military schedules – thanks to Air Express," says Vincent Sillitta, Traffic Manager, Clarostat Mfg. Co., Inc.

"THUNDERBIRD preview color prints get delivered on time by Air Express," says Joseph H. Snyder, President, Color Corp. of America.

"BUYING RUSHES on top-fashion bathing suits are always met by sure Air Express delivery," says Board Chairman of Catalina, Inc., A. Louis Oresman.

Which one has the answer to your problem?

These men are "problem solvers"!

They cut down warehousing spare parts – open up new markets – launch advertising programs in 48 states at once! They beat local competition anywhere in the country!

In short, they use Air Express regularly!

And Air Express can solve a lot of similar problems for you. Your product – or samples, models and promotions – can move from your own door to your customer in a few hours.

Today, Air Express is expanding its fleet of two-way

"NEVER LOST A SHIRT YET because Air Express carries our samples country-wide," says the President of Manhattan Shirt Co., Sylvan Geismar.

"MILLION DOLLAR MENU, possible because Air Express carries our Chinese food samples nationwide," says Jeno Paulucci, President of Chun King Sales, Inc.

"TOURNAMENT CLUBS arrive on time anywhere in the U. S. A. when sent Air Express," says Henry P. Cowen, President, MacGregor Golf Co.

"WE STOP BURGLARS, shipping parts for our alarm systems Air Express," says J. B. Rustic, General Superintendent, American District Telegraph Co.

radio-equipped trucks for pick-up and delivery – cutting time by more than *half* in many markets.

In addition, a private closed-circuit teletype service links the nation's key cities together in a single Air Express network – tied in with scores of other communities. Shipments throughout the country can be "pinpoint" located and controlled all along their route!

Yet, most Air Express shipments cost less than with any other complete air service!

For a faster, surer, more far-reaching delivery system – for information and service – just call your local Railway Express Agency and ask for Air Express.

Air Express

GETS THERE FIRST *via U.S. Scheduled Airlines*

CALL AIR EXPRESS . . . *division of* RAILWAY EXPRESS AGENCY

MACHINE OF

SENECA FALLS AUTOMATIC LATHES CUT MACHINING COSTS FOR ROAD BUILDING EQUIPMENT MANUFACTURERS

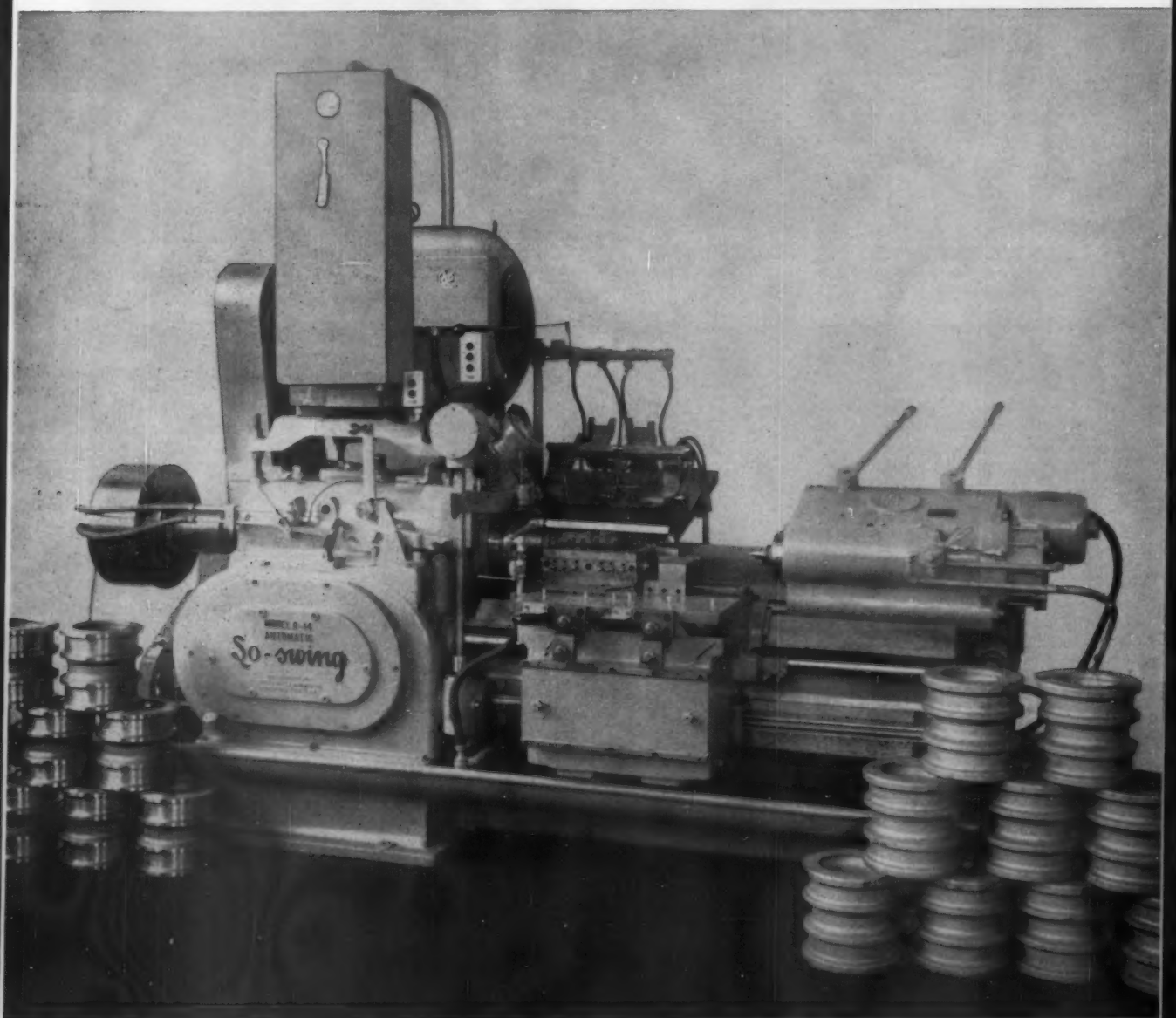


Fig. 1. *A Model "R-14" Automatic Lo-swing Lathe equipped for automatically turning, facing and chamfering Track Rollers in a single operation. The Track Rollers, 9¾" in diameter and 9⅜" long, are held and driven from the rough forged bore with a compensating type, six-jaw, air-operated driver. The tailstock, shown in the withdrawn position, is electrically operated and has a travel of 16" to facilitate loading and unloading of the rollers on the driver. All tools are carbide, operating at 350 ft. per minute. Total floor to floor time is 3.5 minutes each.*

PRODUCTION COSTS

THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK

Today's mammoth Road Building Tractors and Machinery require the most modern and heaviest machine tools to complement the fine engineering and manufacturing skills of Construction Equipment Manufacturers.

The Model "R-14" and "R-18" Automatic Lo-swing Lathes have already demonstrated their fine performance with carbide tools in Construction Equipment Plants. Their rigid construction and ability to stand up under the heaviest cuts, coupled with positive mechanical feeds, wide flexibility and servicing simplicity, are all important advantages of the Model "R" type of Lo-swing Lathes.

Figure 1 is an overall view of a Model "R-14" Lathe equipped for machining track rollers. Figure 3 is a close-up view of the tooling, consisting of six front turning tools, eight heavy rear facing tools, eight small chamfering tools and two chamfering tools for the inside diameter. Note the special cam-operated, 45° inside bore chamfering attachment on the headstock of the lathe. Swivel type tool setting gauges, mounted directly on the tool blocks, reduce tool setting time.

Figures 2 and 4 illustrate turning, facing and chamfering operations on large Cylinder Liners 11½" diameter by 22" long. The liner is held and driven by a special driver, mounted on the headstock spindle, which has two rows of six air-operated driving jaws. Each row is operated by its individual pull bar (Fig. 2) thus equalizing the air pressure on both sets of jaws, which are positioned at the point where the liner wall is the thickest.

The liner is positioned on the driver in relation to the ports, previously cut around the circumference,

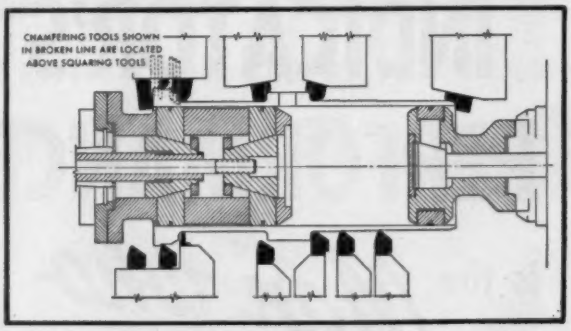


Fig. 2. *Details of arbor construction and location of 22 cutting tools.*

by a locator arm (Fig. 4) which enters one of the ports. An air-operated assist lever then holds the liner tight against the locator until the driving jaws grasp it. A safety switch above the locator arm prevents the machine from being started with the locator in the engaged position.

The relieving type tailstock has a 20" stroke, operated by a motorized lead screw, permitting easy removal of the liners from the long driver. Its large revolving spindle is fitted with an air-operated, ring type, expanding arbor which supports the liner at the tailstock end. A 60 H. P. motor drives the machine and the floor to floor time is 5.2 minutes.

The above are only two of the many parts used by Construction Equipment Manufacturers which may be machined on Lo-swing Lathes with substantial economies. Engineered jobs are our specialty. Our engineering staff is at your disposal to assist in solving your turning problems.

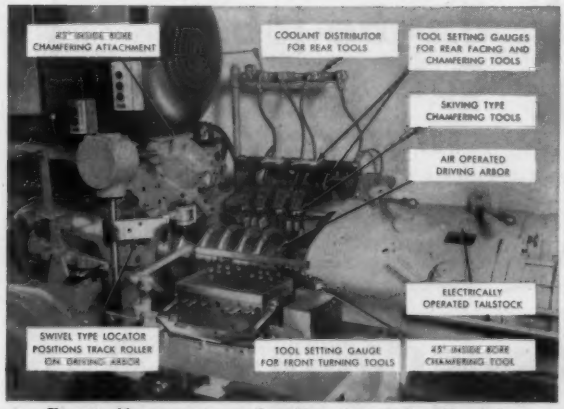

45° INSIDE BORE CHAMFERING ATTACHMENT
COOLANT DISTRIBUTOR FOR REAR TOOLS
TOOL SETTING GAUGES FOR REAR FACING AND CHAMFERING TOOLS
SKIVING TYPE CHAMFERING TOOLS
AIR OPERATED DRIVING ARBOR
ELECTRICALLY OPERATED TAILSTOCK
SWIVEL TYPE LOCATOR POSITIONS TRACK ROLLER ON DRIVING ARBOR
TOOL SETTING GAUGE FOR FRONT TURNING TOOLS
45° INSIDE BORE CHAMFERING TOOL

Fig. 3. *Close-up view of tooling for track roller job.*

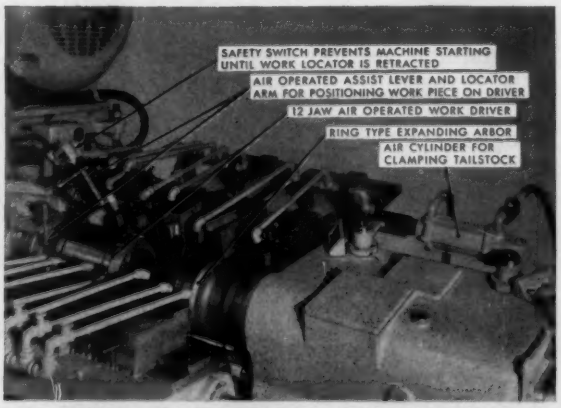
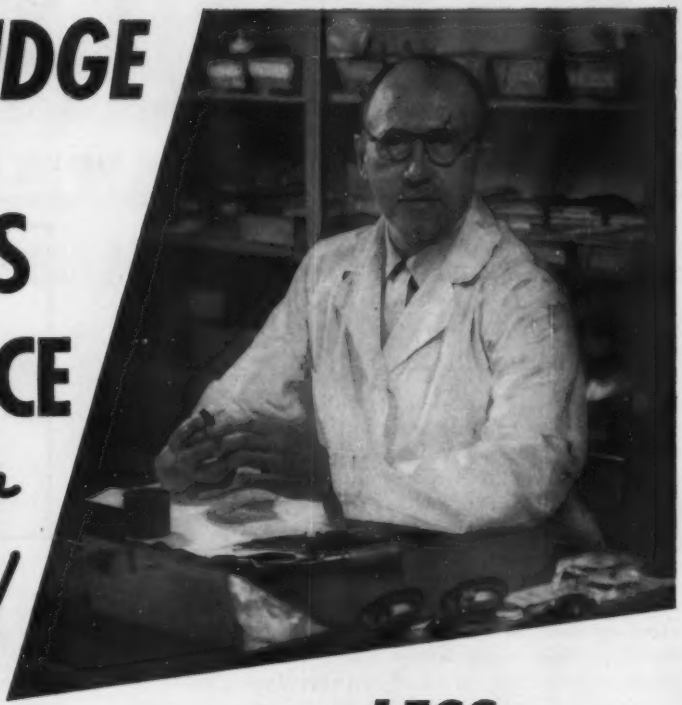

SAFETY SWITCH PREVENTS MACHINE STARTING UNTIL WORK LOCATOR IS RETRACTED
AIR OPERATED ASSIST LEVER AND LOCATOR ARM FOR POSITIONING WORK PIECE ON DRIVER
12 JAW AIR OPERATED WORK DRIVER
RING TYPE EXPANDING ARBOR
AIR CYLINDER FOR CLAMPING TAILSTOCK

Fig. 4. *Close-up view of tooling and tailstock for liner job.*

ARE LOWER WITH *Lo-swing*

The BEST JUDGE of an INDICATOR'S PERFORMANCE is the *Man who Services it!*

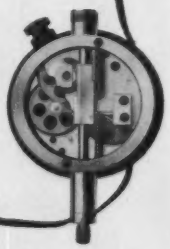


STANDARD

. . . costs LESS does more longer!

Ask the man who repairs your dial indicators why he favors Standard. He'll tell you Standard not only requires far less attention than other makes, but that it's the easiest of all to service. Reasons for this not-to-be-matched ease and economy of maintenance stem from Standard's greater simplicity of design . . . unequalled workmanship . . . exceptionally rugged construction . . . and a 100% shockproof mechanism. Better check your indicator cost today; then talk to the Man from Standard.

100% **Shockproof mechanism keeps** STANDARD **on-the-job... Cuts service time and cost!**



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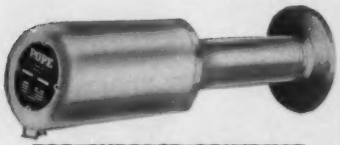
A COMPLETE LINE OF GAGES . . . INDICATING, FIXED AND ADJUSTABLE LIMIT TYPES

POPE engineers and builds 20,000 Different motorized and Belt Driven SPINDLES

one of which may be just the one to LOWER YOUR PRODUCTION COST

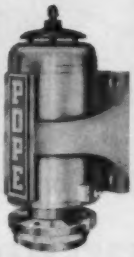
Here are only a few representative Pope Precision Spindles:



FOR SURFACE GRINDING

POPE 1, 2 and 3 HP Totally Enclosed 1800 and 3600 RPM Motorized, Cartridge Type Spindles with double row cylindrical roller bearings of enormous capacity for superior performance and long life, plus separate thrust bearings for no endwise movement of the shaft.

FOR HEAVY DUTY MILLING AND GRINDING



POPE ¾ to 100 HP Direct Motorized Spindles operate in any position — flanged or tapered noses — equipped with super-precision, double-row roller bearings and preloaded ball thrust bearings. Top quality performance is assured on skin milling, grinding, boring and other operations as well as milling.

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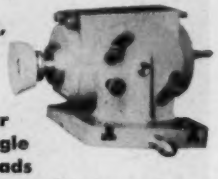
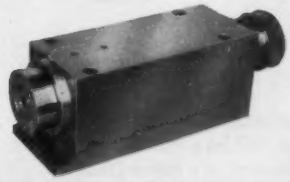


POPE Super-Precision 1 HP, 3600 RPM Motorized Tool and Cutter Grinder Clearance Angle Swivelling Heads provide angular adjustment in a vertical plane. They pay for themselves in time saved. Cup wheels can be used for practically all clearance angles.



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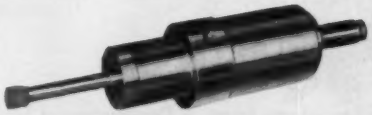
POPE Heavy Duty Boring Spindles assure smooth, chatter free, continuous high production of accurate parts. Belt driven or motorized, in a wide range of horsepowers and speeds.



FOR INTERNAL GRINDING

POPE Precision Internal Grinding Spindles have the super-precision bearings to withstand both axial and radial loads and to produce better finished ground holes. Their ability to take heavy cuts means increased production. Wheel life is increased, too. For Bryant, Cincinnati, Excello, Heald, Landis and Norton Grinders.

FOR HIGH CYCLE GRINDING AND MILLING

POPE Super-Precision, High Frequency, Heavy Duty Spindles are available for speeds up to 100,000 RPM. They are unequalled for low cost maintenance, long life, trouble-free operation and rugged ability to cut metal fast.

Send us your specifications and get prompt quotations on the one best Spindle for you out of the 20,000 different Precision Spindles that bear the name "POPE."

No. 116

Specify POPE® PRECISION SPINDLES

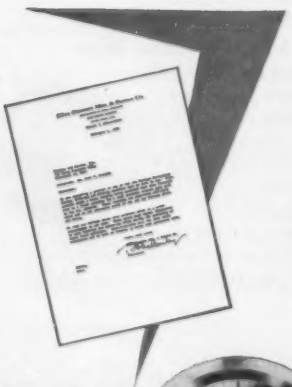
POPE MACHINERY CORPORATION

Established 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

Photo courtesy 20TH Century Mfg. & Supply Co., Tulsa, Oklahoma

"We are extremely proud of the job our PORTAGE mills are doing"



The Portage Machine Co.
Akron, Ohio

Gentlemen:

Our business, as you know, is Contractors of Metal Products. This particular job is a steel forging being machined, and when finished will be a fluid cylinder for a high pressure pump used in the oil industry. These forgings are made from AISI-4140 steel and we are extremely proud of the job PORTAGE mills are doing.

We find our PORTAGE mills very accurate. These mills must repeat themselves in each location and operation often during the machining operation. Specifications call for very close tolerances and we have no trouble in doing this precision work.

Yours truly,
20TH Century Mfg. & Supply Co.

R. G. Galloway
President

THE Portage MACHINE CO.

1026 Sweitzer Avenue • Akron 11, Ohio
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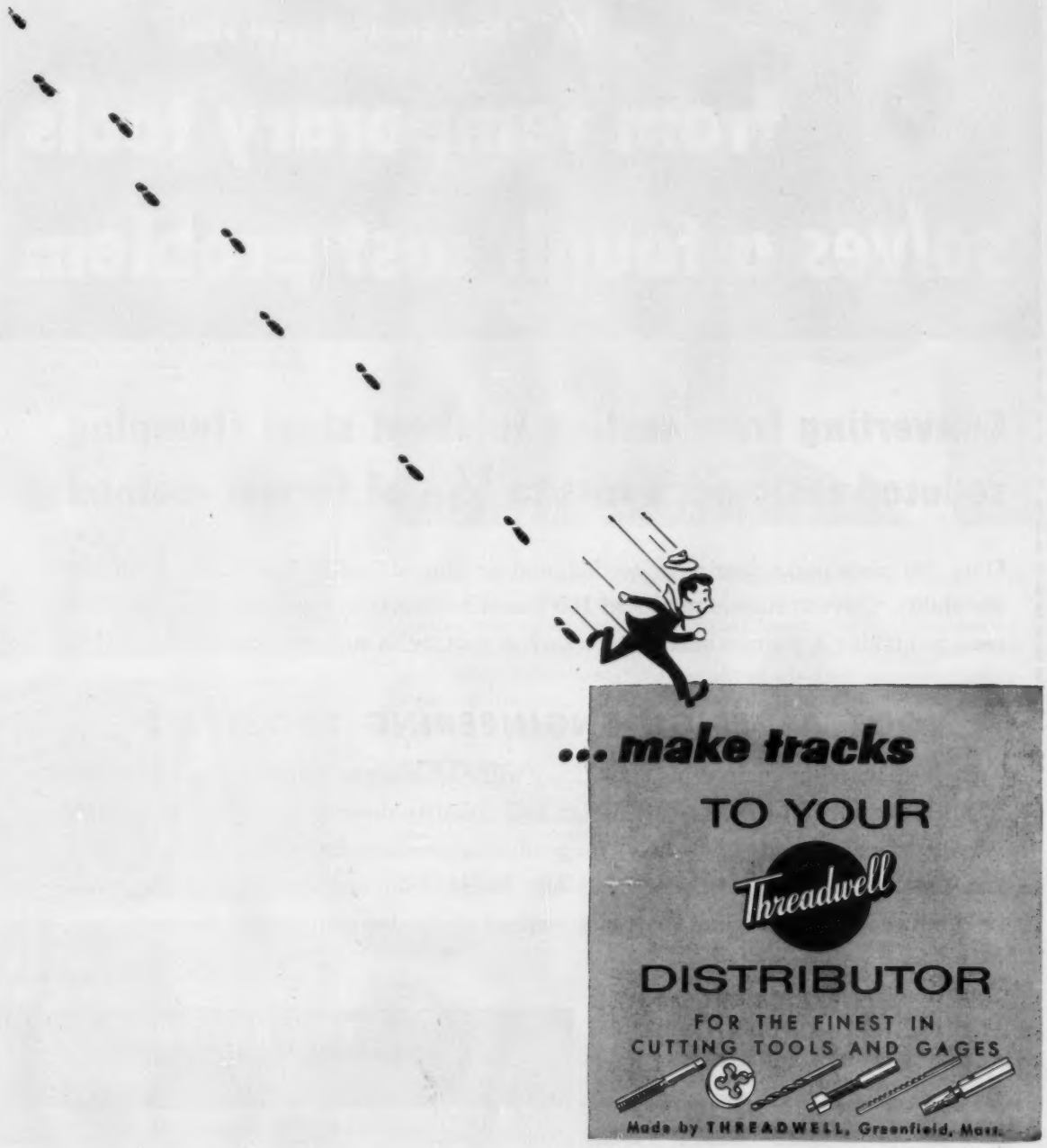
BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916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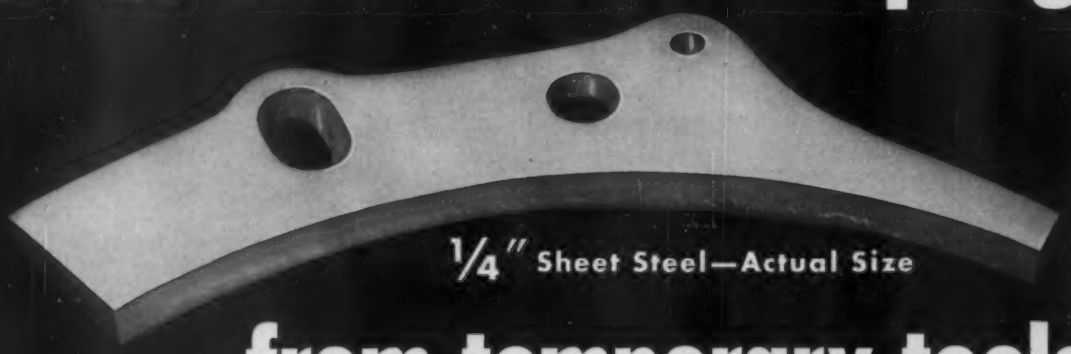
TO YOUR
Threadwell
DISTRIBUTOR
FOR THE FINEST IN
CUTTING TOOLS AND GAGES
Made by THREADWELL, Greenfield, Mass.

D-R small lot stamping



from temporary tools *solves* a tough cost problem

Converting from casting to sheet steel stamping reduced customer's cost to 1/10 of former method

Only 200 piece parts/year were needed, and an annual design change was a further possibility. Dayton Rogers produced 100 pieces for less than the cost of the tool steel used in making a conventional die for such a part, with superior results.

GOT A DESIGN-ENGINEERING PROBLEM?

Take it up with our engineering staff. They will cost-analyze your requirements, both from the standpoint of piece-part design and quantity desired. We offer the nation's very best facilities and "know-how" for producing precision die-cut stampings in small lots. Custom-made parts of practically any design, from any stamping material, can be produced by our original short-run method at the lowest possible die cost.

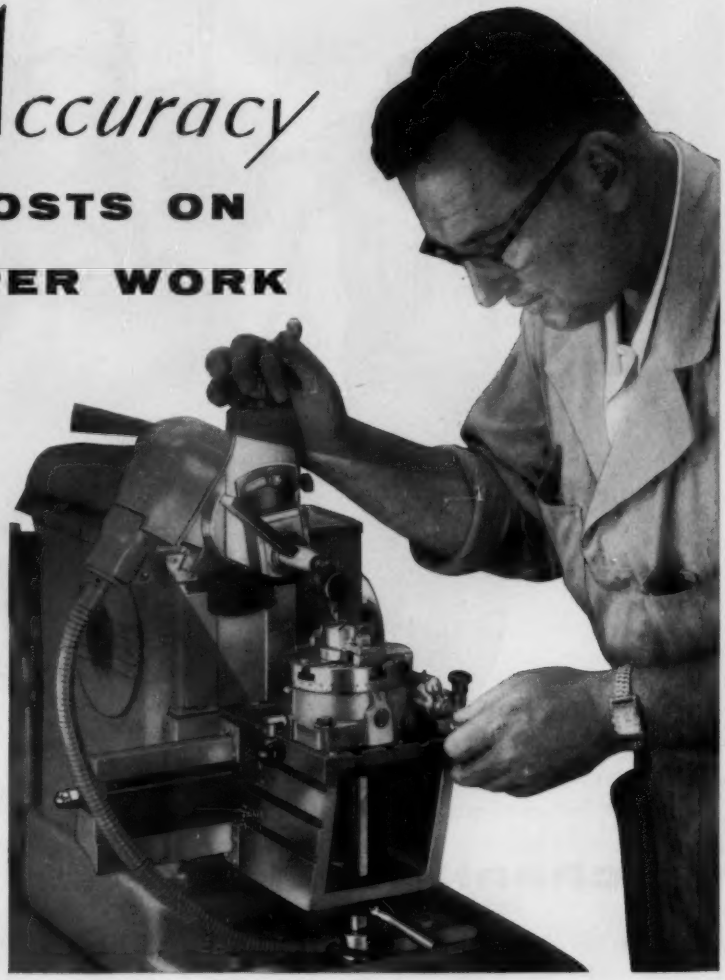
SEND YOUR SKETCH, BLUEPRINT OR PART, PLUS QUANTITY, FOR PROMPT QUOTATION

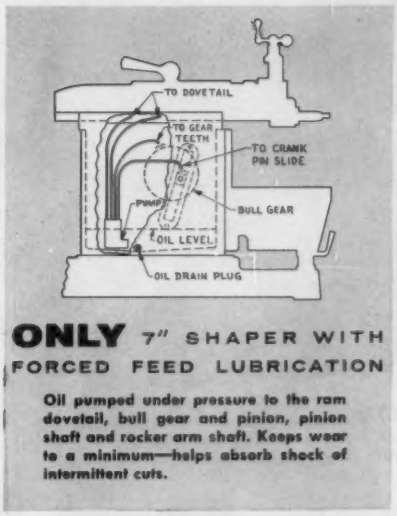
DAYTON ROGERS
Manufacturing Company

MINNEAPOLIS 7H, MINNESOTA

Speed-Accuracy

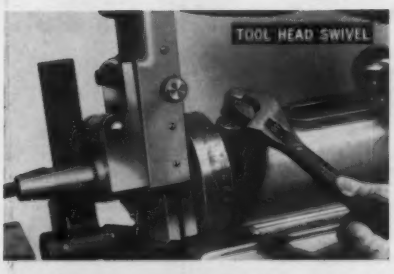
TO CUT COSTS ON SHAPER WORK

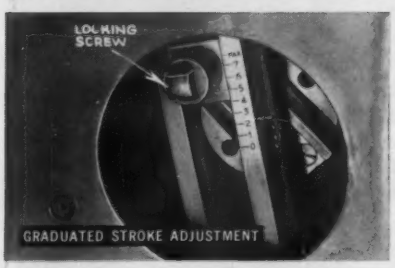




ONLY 7" SHAPER WITH FORCED FEED LUBRICATION

Oil pumped under pressure to the ram dovetail, bull gear and pinion, pinion shaft and rocker arm shaft. Keeps wear to a minimum—helps absorb shock of intermittent cuts.



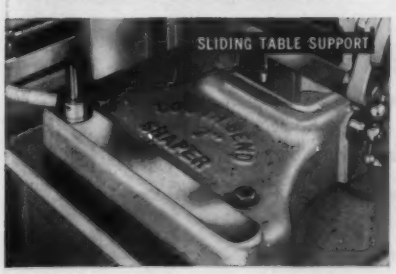


The cost of machining small work drops when a South Bend 7" Precision Bench Shaper takes over. Its higher strokes per minute—greater ease of set-up—and handling speed give it a decided advantage over larger shapers that never were designed for small work. Also, its accuracy is a match for exacting toolroom requirements. If you are interested in better shaper work at lower costs, write for literature. Price, less motor and stand—$573.

SPECIFICATIONS

Ram Stroke—0 to 7". *Strokes* per min.—42 to 195 approx. *Cutting Speeds*—3 to 114 ft. per min. *Tool Head*—3" vertical travel, 360° rotation. *Table*—9½" horizontal travel. 5" vertical travel. *Table Power Cross-Feeds*—(6) .002" to .012" (reversible).

SOUTH BEND LATHE SOUTH BEND 22, INDIANA



BUILDERS OF LATHES, VERTICAL SPINDLE MILLING MACHINES, SHAPERS, DRILL PRESSES, PEDESTAL GRINDERS

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Hard-Facing Gives This Valve Part A Longer Life In High-Temperature, High-Pressure Service.

Mechanization Speeds Production . . .

Cuts Cost of Hard-Facing by 40%

Valve parts hard-faced with HAYNES STELLITE alloy No. 6 have unusual resistance to oxidation, erosion, seizing and galling, corrosion, and abrasion. They will withstand wear even at elevated temperatures, and operate for long periods of time in high-temperature, high-pressure service.

Reclaiming worn valve parts or protecting new ones by hard-facing has always been an economical practice. Now mechanization has made it even more attractive. Mechanized hard-facing is fast . . . up to four times faster than manual methods. It produces smooth, sound deposits that require less finishing time. And because it provides closer control over the hard-facing operation, less rod and less oxygen and acetylene are consumed.

Haynes Stellite Company designs and produces mechanized equipment for depositing hard-facing rods by the oxy-acetylene process. Machines are available for surfacing flat, longitudinal surfaces; flat, angled or grooved parts; and for handling cylindrically shaped parts. Write to any district office for more information on mechanized equipment and on the 19 HAYNES hard-facing alloys.

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Makes reading easier. . . quicker

Kodak Industrial X-ray Film, Type AA, gives you greatly increased speed — a film characteristic that brings the radiographer greatly extended possibilities.

As an example: by using reduced kilovoltage and usual exposure time, greater radiographic contrast and easier readability are obtained.

In addition to ranging up to double the speed, this new film retains the fine sensitivity characteristics which made Kodak Type A the most widely used x-ray film in industry.

Kodak Industrial X-ray Film, Type AA, can save you time and extend the usefulness of your present radiographic equipment. Get all the details. Contact your x-ray dealer or Kodak Technical Representative.

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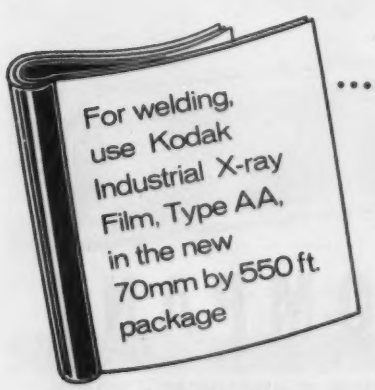

Read what the new Kodak Industrial X-ray Film, Type AA, does for you:

- Reduces exposure time—speeds up routine examinations.
- Provides increased radiographic sensitivity through higher densities with established exposure and processing technics.
- Gives greater subject contrast, more detail and easier readability when established exposure times are used with reduced kilovoltage.
- Shortens processing cycle with existing exposure technics.
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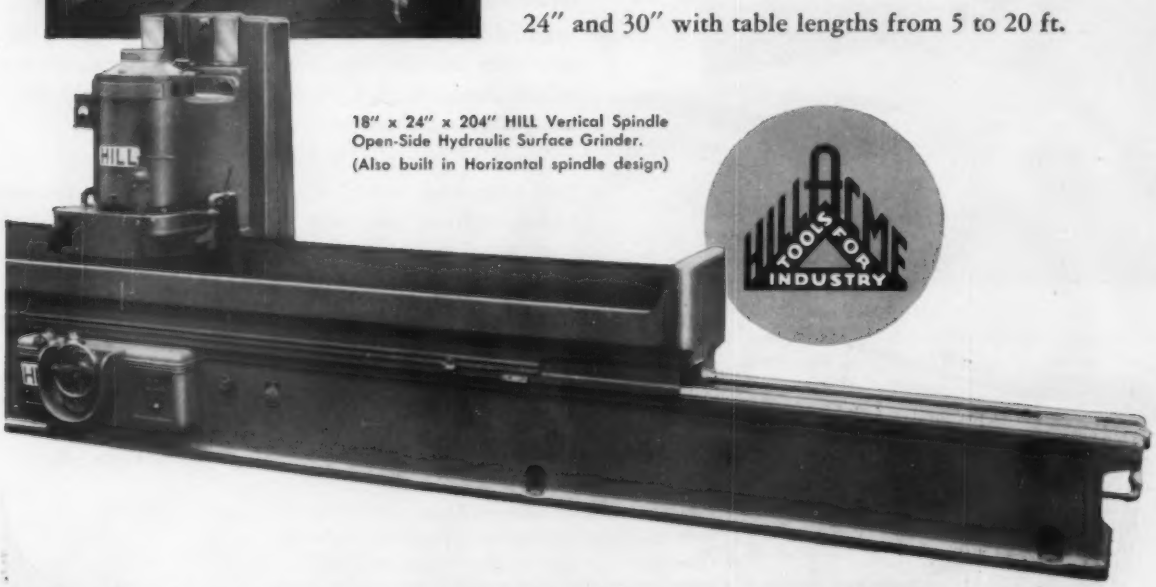
TRADE MARK

EVERY HEAVY DUTY SURFACE GRINDER SHOULD HAVE:

- *Open-side Accessibility*
- *100% Hydraulic Table Drive*
- *Built-in Spindle Motor*
- *Centralized Controls*
- *Low Pressure Hydraulic System*
- *One-Shot Lubrication System*
- *Adequate Safety Devices*

BUT THEY DON'T—

So GET A HILL with ALL the above features *plus* many other design improvements which insure rapid stock removal and accurate grinding of flat surfaces within the periphery of the grinding wheel. HILL Vertical Spindle grinders are built in table widths of 18", 24" and 30" with table lengths from 5 to 20 ft.



18" x 24" x 204" HILL Vertical Spindle Open-Side Hydraulic Surface Grinder. (Also built in Horizontal spindle design)

HILL ACME TOOLS FOR INDUSTRY

THE HILL ACME COMPANY

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"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

MICRO SWITCH . . . FIRST IN PRECISION SWITCHING

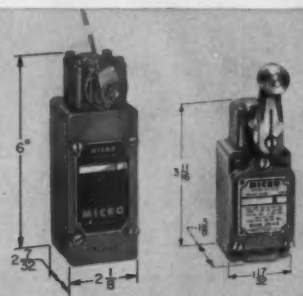
How plant operators use MICRO SWITCH Precision Switches to speed materials handling

Plant engineers find MICRO SWITCH precision switches ideal for keeping production lines running smoothly.

Small in size, high in electrical capacity, versatile in application, these switches may be used everywhere —in process, bulk, flow and level controls; on package and part conveyors; in counting and weighing devices; as manual push-button controls; and to automatically control mechanical motion of machines and equipment.

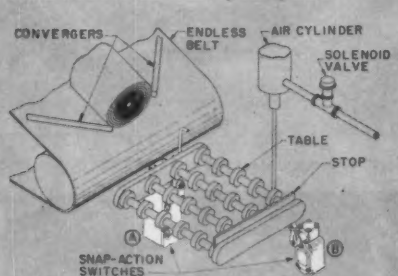
Here are two practical examples of the way these switches have been used to speed materials handling:

Automatically unload tied bundles

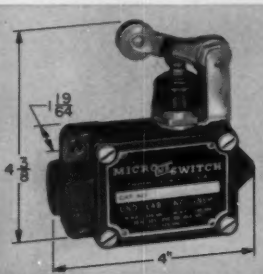


Two MICRO SWITCH precision switches, of different types, unload tied bundles from this conveyor. They also prevent bundles from piling up at the end of the conveyor.

Bundles, which come from the floor above, are centered by two convergers. Each bundle actuates Switch A (with long feeler) as it passes on to the ball bearing table. The switch operates a timing device which stops the conveyor and operates a solenoid air cylinder. This tilts the table, dropping the bundle into a hand truck below. When the table returns to normal position, it actuates small limit Switch B which starts the conveyor again.



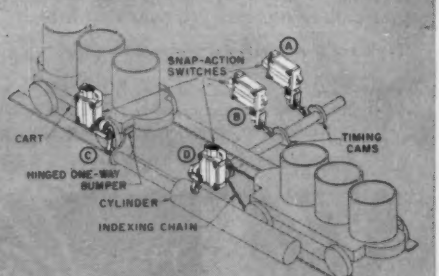
Four switches position moving carts on conveyors



On the forward stroke of a hydraulic cylinder ram the carts are moved forward by a hinged one-way bumper.

The switch circuit ties the hydraulic cycle in with the mechanical timing cycle and prevents the next loading operation until the cylinder ram has moved the preceding carts ahead on the conveyor.

Switch C closes on the forward stroke of the ram. A timing cam closes Switch A. This reverses the hydraulic ram to the back position where it closes Switch D. When Switch B is closed by the timing cam, the ram again moves out and pushes the carts forward on the conveyor.



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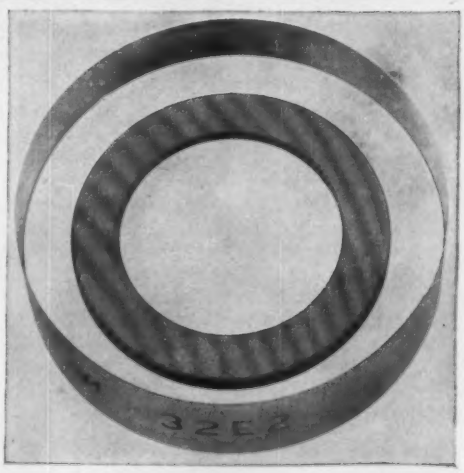
Check Seals for flatness....

...with VK LIGHT WAVE EQUIPMENT

Van Keuren Light Wave Equipments, standard gage laboratory equipment everywhere, have long been used for checking gage blocks, toolmaker's flats, comparator anvils and other lapped surfaces in the laboratory or inspection room. In recent years, however, VK Light Wave Equipments and flats have become valuable tools on production inspection jobs. Typical is the growing use of optical flats in checking sealing rings of various materials.

The illustration at right of a sealing ring under a 3" diameter fused quartz optical flat shows how easily measurements can be made. The ring* is acceptable on sight. The bands indicate excellent surface finish (sharp definition of bands), and no warp or low edges (uniform band spacing). Flatness is within .000005" across entire ring, and .000002" across ring face (bands curve less than ½ band interval over entire ring, and 1/6 over ring face).

*Product of Sealol Corp., Providence, R. I.



VK Optical Flat and Seal Ring

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

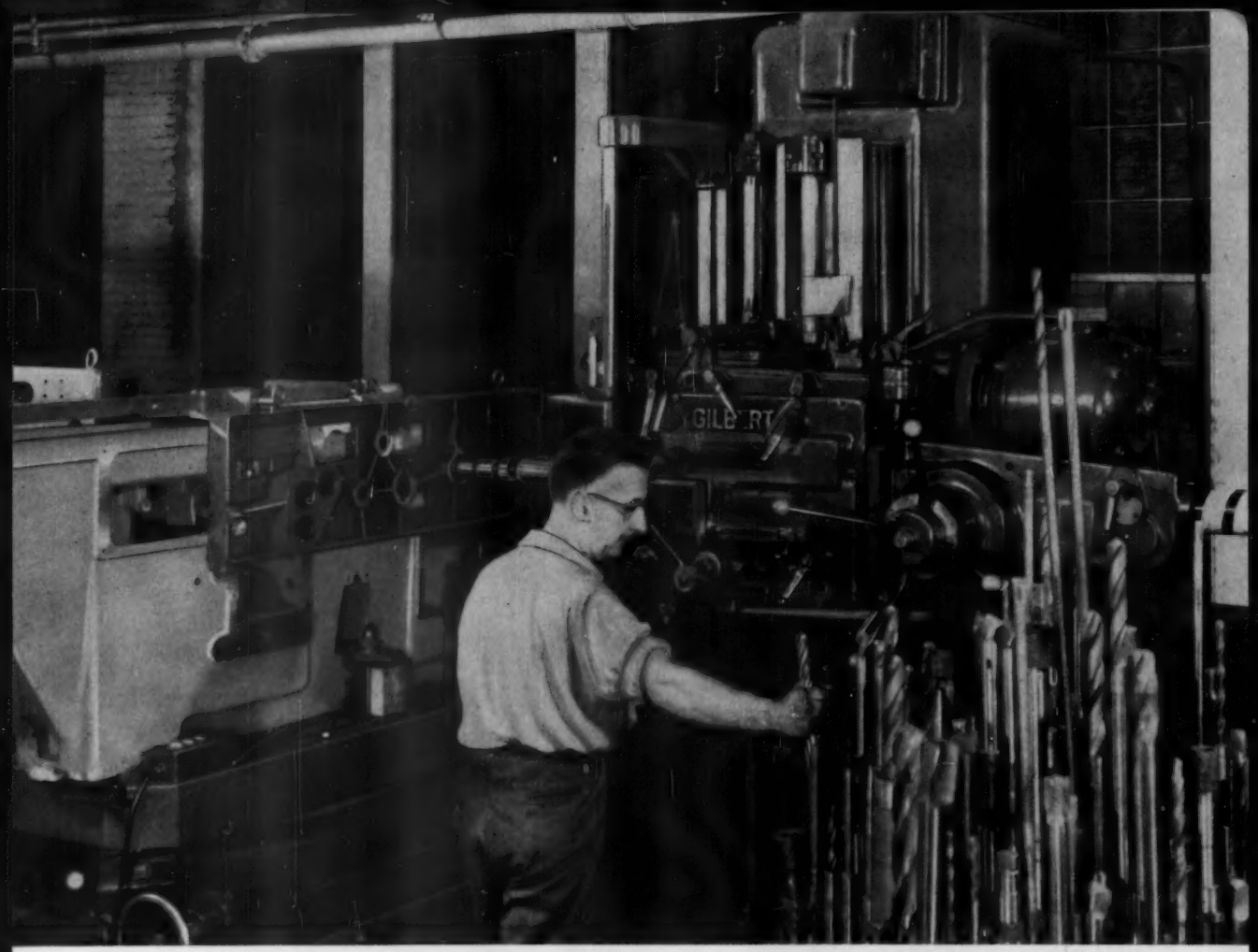
VK

38th YEAR

THE Van Keuren CO.,

173 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Carbide Pivots . . . Precision Lapping Service.



courtesy Brown & Sharpe Mfg. Co.

Brown & Sharpe cuts time 75% with Gilbert boring mill

"The handling time on this job has been reduced by 75% and the machining time has been reduced by 40%," says T. R. Buckles, Equipment Engineer for Brown & Sharpe Mfg. Co.

These profitable savings were earned by fitting a Cincinnati Gilbert boring mill with a Gilbert revolving table, adjustable on runway, and traveling tool holder designed by Brown & Sharpe.

There are about 180 holes in the workpiece. The boring mill performs drilling, reaming, tapping, or boring operations as well as some milling cuts. The job was formerly done on a radial drill, portable drill, and floor type miller.

This is another typical example of the time saved (and profits earned) by Cincinnati Gilbert horizontal boring mills. Our man will be glad to show you more examples.

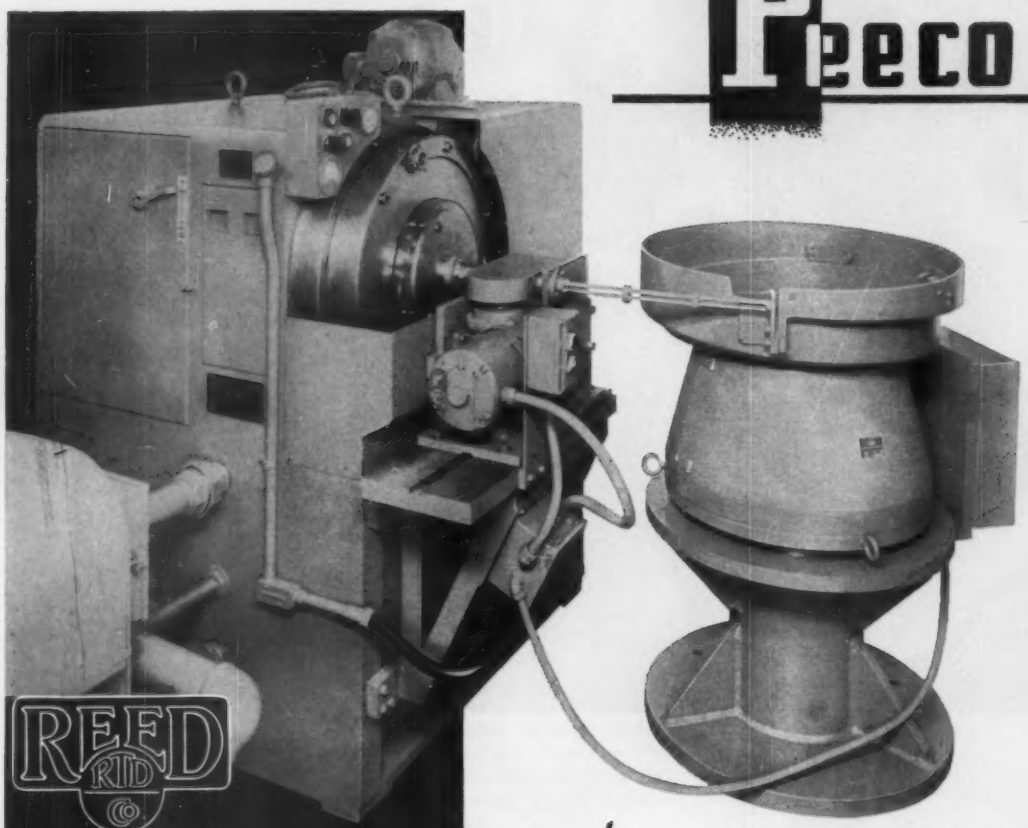
The Cincinnati Gilbert Machine Tool Co.
3340 Beekman Street, Cincinnati 23, Ohio

Low-cost financing plan—6% simple interest (3% add on), up to 5 years to pay—makes your purchase of Gilbert equipment immediately feasible.

those who buy Gilbert buy **GILBERT** *again*

PRODUCTION EQUIPMENT

produces MORE with Peeco



REED ROLLED THREAD DIE CO.
production equipment *Now* includes
DEVELOPED Peeco FEEDERS

The PEECO Vibratory Parts Feeder (Model 25) pictured here is the feeding mechanism which supplies a continuous flow of blanks for the A23 Reed Thread Rolling Machine. Production rate of this machine for rolling high pressure stud threads varies from 70 inches (and up) per minute, depending upon the outside diameter of the blank and the number of threads per inch to be rolled.

Peeco

As a leader in the field of vibratory parts feeders PEECO is contributing its share towards the greater capacities being achieved by new production equipment. We are glad to include, among the companies in this field now being served by PEECO, the Reed Rolled Thread Die Co. of Holden, Massachusetts, specialists in thread and form rolling tools and equipment.

If you want to produce more, send for bulletin # 536 and ask for the name of the PEECO representative in your area.

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF VIBRATORY PARTS FEEDERS

PERRY EQUIPMENT & ENGINEERING CO.

ERIE, PA. • • • DIVISION OF AUTOMATION DEVICES, INC.

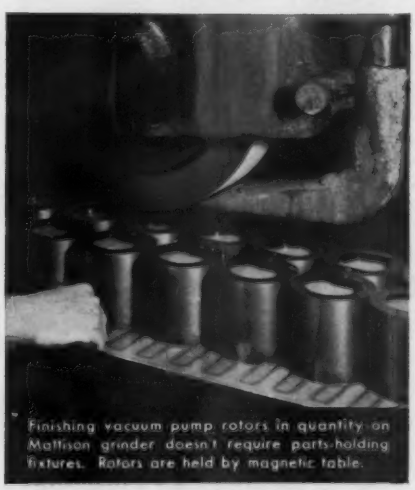
CASE HISTORY NO. 38—VACUUM PUMP ROTORS

MATTISON
HIGH-POWERED
PRECISION

GRINDING METHODS

Courtesy: Central Scientific Co., Chicago, Ill.

Switch to Mattison surface grinder doubles output . . . consistent accuracy speeds assembly



Finishing vacuum pump rotors in quantity on Mattison grinder doesn't require parts-holding fixtures. Rotors are held by magnetic table.

Not only is output doubled, but improved accuracy being achieved on this Mattison high-powered precision surface grinder enables rotors for high vacuum pumps to be assembled more rapidly. Production now is 50 parts per hour compared to 12 to 25 per hour with former grinding method.

Stock removal on this job is .0015 inch with a high degree of accuracy required. Both parallelism and flatness are held to .0003 inch to assure consistent pump performance at very low pressures.

Greater accuracies also are being realized in machining a wide variety of other scientific apparatus parts. Very thin vanes for another vacuum pump, previously ground one at a time, are now ground in production lots. Reproduceability is greatly improved.

Like every Mattison grinder, this horizontal spindle unit features high horsepower and rigid construction—the design combination that means ability to handle a wide range of work with unmatched accuracy at high production rates.

MATTISON
MACHINE WORKS
ROCKFORD ILL. U.S.A.

HIGH-POWERED
PRECISION
SURFACE
GRINDERS

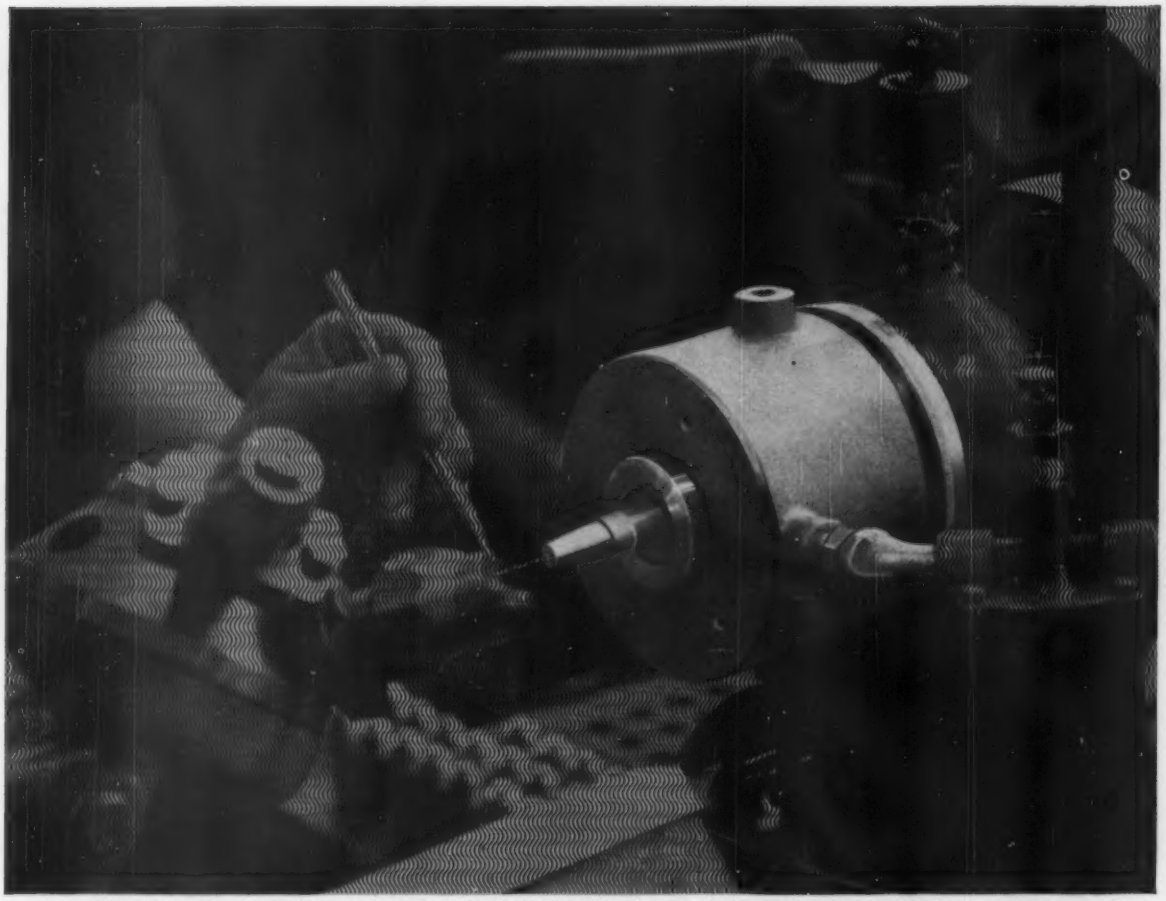


Photo: *Courtesy Harris Calorific Company, Cleveland, oldest and largest independent producer of gas welding and cutting equipment in the country.*

ERICKSON AIR CHUCKS

a hot tip for cutting costs on cutting-torch tips

Erickson '09 Model Air Chuck for heavy work. Quick-acting air chuck, with leverage principle, gives 3 to 4 times holding power of ordinary chucks.

"We have used Erickson Chucks since 1942 . . . and would recommend Ericksons to any plant which wants to increase production . . ." That is the report from Harris Calorific Company, big-name manufacturer of gas cutting and welding equipment.

The company uses four No. 400 Erickson Air Chucks for finishing leaded copper cutting-torch tips. Operations consist of drilling, reaming and polishing—at the rate of approximately *100 pieces per hour per chuck*.

Compared to previous methods, Harris Calorific Company claims, trueing-up time has been cut 70% . . . chucking time 60% . . . set-up time 25%.

Let an Erickson representative show you how to cut your production costs—*accurately*—with Erickson Air Chucks.

AA-3798

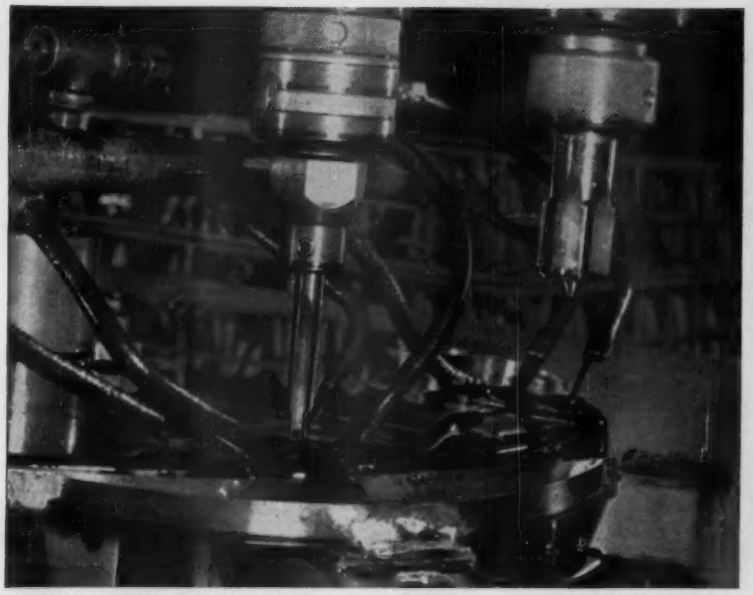
Bothered by a tough holding problem? Then let us show you how Erickson holding tools speed production, lower costs. Call us or write for Catalog K.

ERICKSON TOOL COMPANY

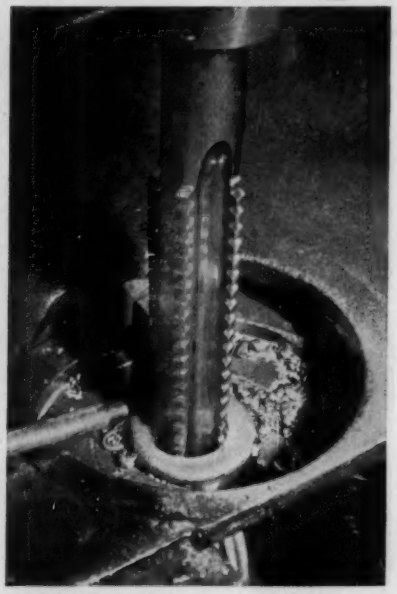
2309-2 Hamilton Avenue • Cleveland 14, Ohio

COLLET CHUCKS
FLOATING HOLDERS
TAP CHUCKS
TAP HOLDERS
AIR-OPERATED CHUCKS
EXPANDING MANDRELS
EXPANDING-COLLETS
SPECIAL HOLDING FIXTURES

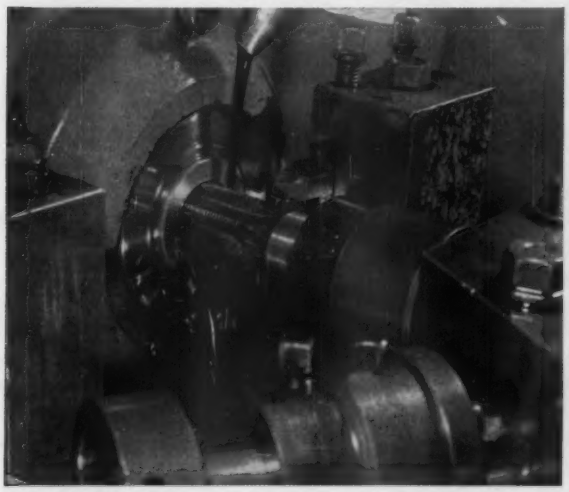
Cutting Tool and Gaging Methods . . . by BESLY



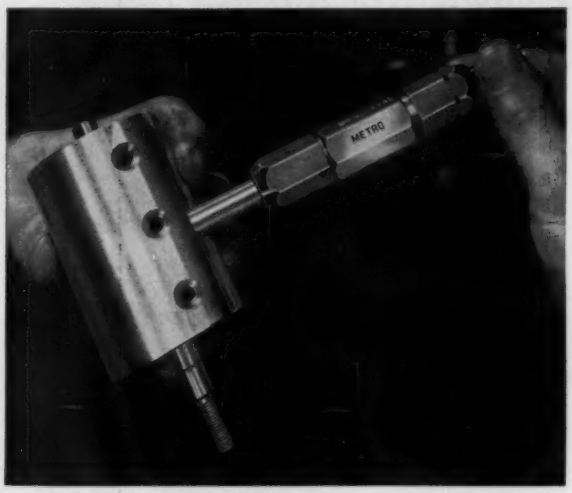
MATCHED TO THE JOB — At The Chicago Screw Company, Bellwood, Illinois, two sizes of Besly taps, poised above an indexing table, are ready to tap C-1141 steel parts. Operating alternately, the smaller 3/8"-24 Besly tap quickly threads a hole, then the work indexes beneath the 1 5/32"-24 Besly tap and a larger hole is threaded. By using Besly's Engineering Service, this company realized lower costs and a better job. The right taps were carefully selected and matched to the specific threading requirements.



SQUARED OFF — Templeton, Kenly & Company, Broadview, Ill. cuts heavy, almost square threads in malleable iron bases of rugged 12 to 24-ton screw jacks with Besly acme thread form Taps. Notice mirror finish on flutes promoting greater chip clearance.



TOUGH GOING — Here you see a C-1018 high carbon steel nut being threaded by a Besly 1 3/4" tap. Extremely abrasive, because it has been carburized and heat treated, the material is difficult to tap. However, Besly taps tested on the work, proved they could "take it" and were specified by this manufacturer for the job.



ASSURED ACCURACY — To assure that holes in planer cutter head assemblies provide precise fits for set screws, SKIL Corporation, Chicago, checks for accuracy with Besly-Metro Double End Reversible Cylindrical Plug Gages. Two opposed blades have three holding set-screws and another for adjusting position.

Prove to yourself that Besly Cutting Tools and Gages produce better results. Put them on trial on your toughest jobs, and check the difference in longer tool life, less down time, fewer rejects and faster production. If you'd like to try Besly tools or use Besly's Engineering Service, see your Besly distributor for details, or write us . . .

Engineering, Service and "Specials"... are a Besly Specialty

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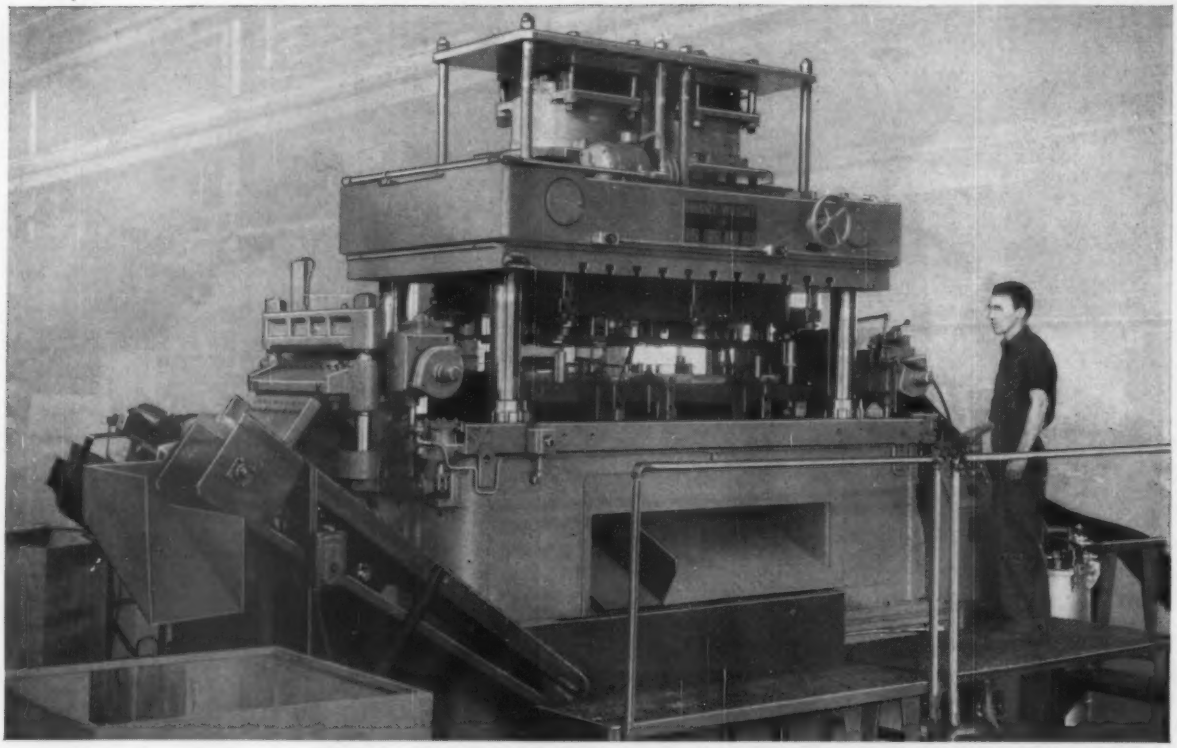
BESLY-WELLES
CORPORATION

120 Dearborn Avenue
South Beloit, Illinois

TAPS • DRILLS • REAMERS • END MILLS • TOOL BITS • GAGES
CARBIDE TIPPED TOOLS, BLANKS, THROWAWAY INSERTS and HOLDERS



Henry & Wright Double Crank

"definitely improved our competitive position"

TO KEEP PACE with trends in progressive stamping, Grand Haven Stamped Products Co., Grand Haven, Mich., bought a 100-ton Single Crank Henry & Wright in 1954. Its performance was so impressive, Grand Haven purchased a 200-ton Double Crank in 1956.

ON VERY FIRST JOB the new machine equalled expectations. The part involved — an automotive vent grill — is produced two at a time on a multi-station die from a 15⅝" strip of 22-gauge, cold-rolled steel, at 124 pieces per minute.

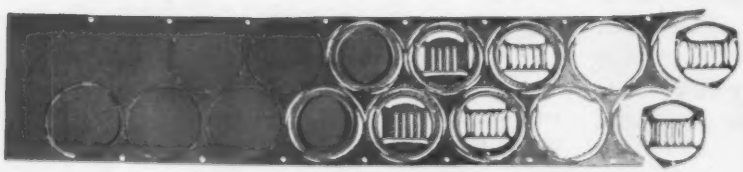
THREE OR FOUR conventional presses would have been required to produce this part, it is estimated by Emil Gaul, Grand Haven vice president. Among the features he likes about the Double Crank are: unequalled flexibility afforded by the large bed area, rapidity of die change, inching control and safety devices.

"Definitely improved our competitive position," is the way Mr. Gaul sums up the performance of his Henry & Wrights. They can improve productivity and work quality in your plant, too. Write for our catalog.

HENRY & WRIGHT

Division of Emhart Mfg. Co.

Hartford, Connecticut



Six- and seven-station twin die lances, flattens, draws, pierces, forms and blanks out.

First Showing!

KNIGHT'S

NEW NO. 60

Metalworking's most accurate, fast and

VERSATILE VERTICAL

PRECISION BORING....and MILLING

- Unusual extra capacity
- Solid table support
- Choice of 3 measuring devices
- Big heavy bed-type table
- Extra cross & vertical travel
- Easy simplified operation

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ATTACH TO COMPANY LETTERHEAD

TWO TABLE SIZES
18" x 52"—28" longitudinal travel
18" x 60"—36" longitudinal travel

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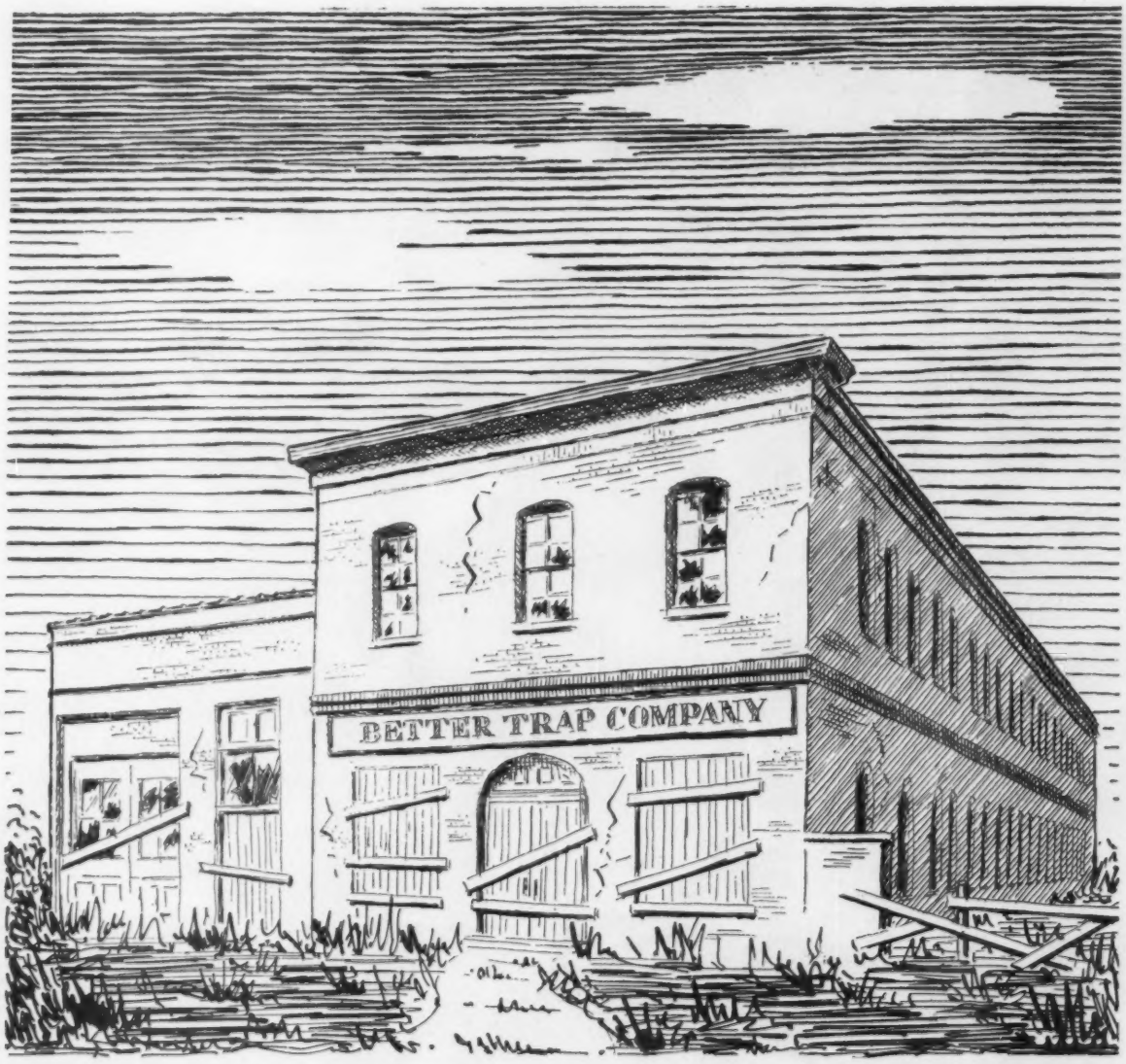
W. B. KNIGHT MACHINERY CO.
3920 West Pine Blvd., St. Louis 8, Mo.
Send complete information on new No. 60 Vertical.

Name.....

Title.....

☐ Have representative call



MOUSETRAP, STEAM TRAP, SEWER TRAP

. . . it makes no difference

. . . the world *won't* beat a path to the door of the man who builds a better one *and then doesn't advertise it* so that people will know about his product, know where it can be bought and how much it costs.

Advertising benefits the buyer, too. It tells you the product story, makes it easy for you to buy. Even more important to you, advertising leads to mass production and volume sales . . . which means lower costs and lower prices.

Yes, "Advertising Benefits You" . . . 'specially business-paper advertising.

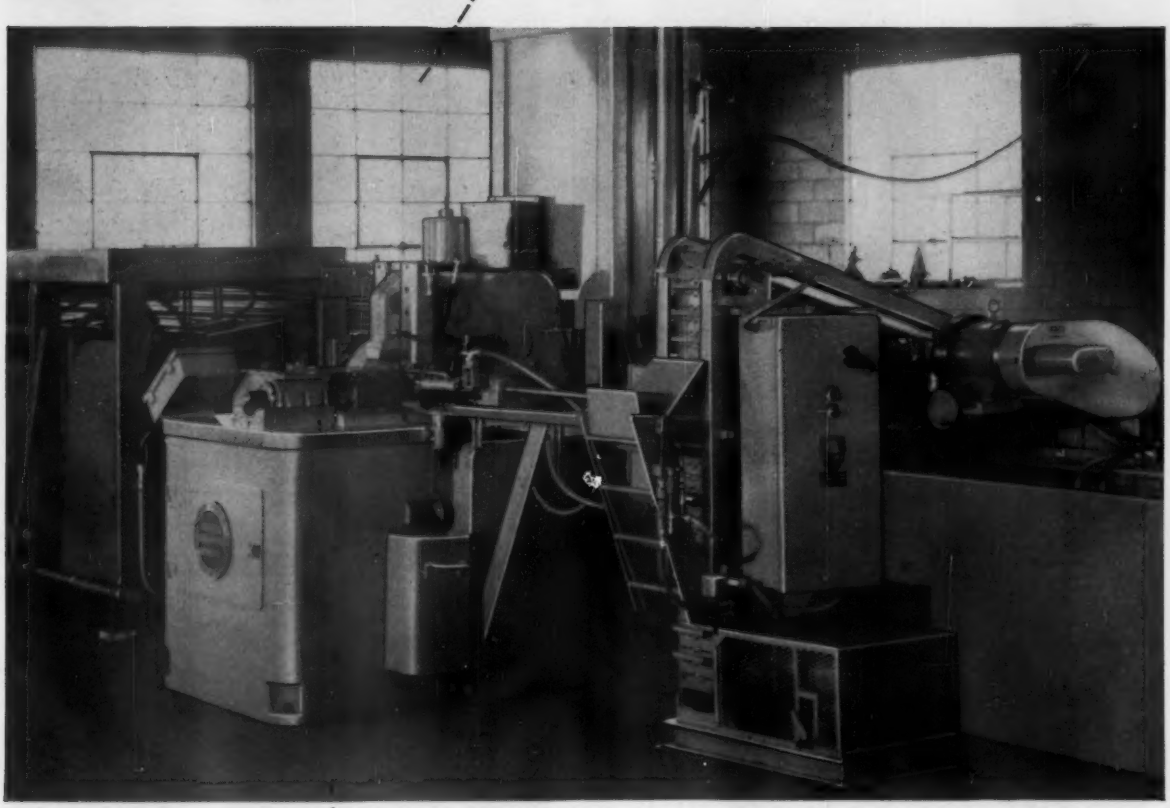
McGraw-Hill Magazine of Metalworking Production

American Machinist

330 WEST 42ND ST., NEW YORK 36, NEW YORK

One Grieder Tube Cut-off Machine Is Producing...

2400 Crankcase Filler Tubes Per Hour For A Major Automobile Manufacturer



Tube Specifications

Mechanically welded 1⅜" OD, .035" wall thickness, mild steel supplied in 22' lengths. Cut off in lengths of 9.070" plus or minus .002" with both ends finished burr free.

The Grieder Tube Cut-off Machine cycling at the low end of its 4500 to 6000 pieces per hour rate runs intermittently. Production on this application is limited by the cycling rate of the special end finishing machine to which it is coupled. This complete line of machinery is electrically interlocked for automatic operation.

Grieder Tube Cut-off Machines are made in three sizes to accommodate tubes of any shape from 3/16" to 4" OD. Hoppers for automatic feeding of tubes are available as extra equipment. Write for literature.

GRIEDER INDUSTRIES, INC.

P. O. BOX 169, BOWLING GREEN, OHIO

DRILL FINISHED* HOLES

IN ONE *HIGH-SPEED* OPERATION

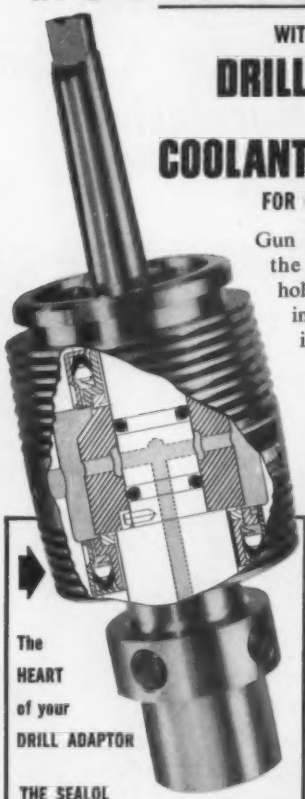
WITH SEALOL'S

DRILL ADAPTOR

AND

COOLANT SUPPLY UNIT

FOR GUN-DRILLING



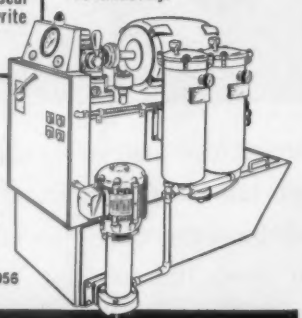
The HEART of your DRILL ADAPTOR

THE SEALOL Mechanical Seal provides positive protection against leakage along a rotating shaft. Widely used in aviation, process, oil and other industries. For specific seal application in your business, write Sealol today!

Gun drilling has revolutionized the production of accurate holes. For example, gun drilling saved $12,674.52 in drilling three shallow holes in each of 342 breech rings at the Watervliet Arsenal. Manufacturing methods engineers say that production time was cut by 71%!**

Your plant can save substantially and increase production by adapting your present drilling equipment for gun drilling with Sealol's Drill Adaptor and Coolant Supply Unit.

SEALOL DRILL ADAPTOR — transfers coolants from a stationary source to the rotating gun drill at speeds to 10,000 RPM — pressures to 1,000 PSI. Coolant is delivered through gun drill directly to cutting edge. Work runs cool, chips are flushed out continuously.



SEALOL HI-PRESSURE COOLANT SUPPLY UNIT — filters, cools and pumps coolant at pressures to 1,000 PSI — volume to 40 GPM (higher capacities available) for precision drilling of all types.

*to Gun Drill Tolerances
**American Machinist — Aug. 13, 1956

SEALOL CORP.

DEPT. I WARWICK INDUSTRIAL PARK, PROVIDENCE 5, R. I.

Please send me Bulletin information on Sealol gun drilling equipment.

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COMPANY _____

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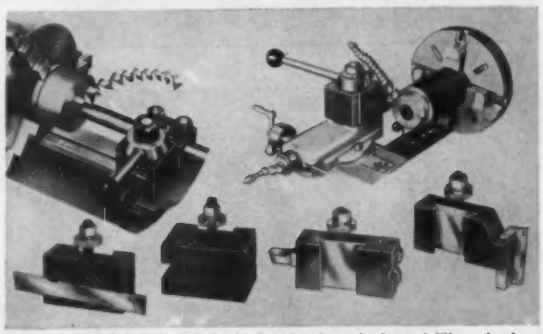
ALORIS QUICK CHANGE TOOL POSTS & HOLDERS

Speed Your Operation .... Save You Money



Only a second to change tools for turning, facing, drilling, boring, threading, knurling, cutting off or any other operation.

- Great Repetitive Accuracy
- Rugged Construction
- Tested and Recommended by Leading Lathe Manufacturers
- Greater Rigidity
- Saves 90% in Set-Up Time
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Write for catalog and price list.

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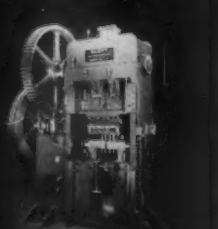
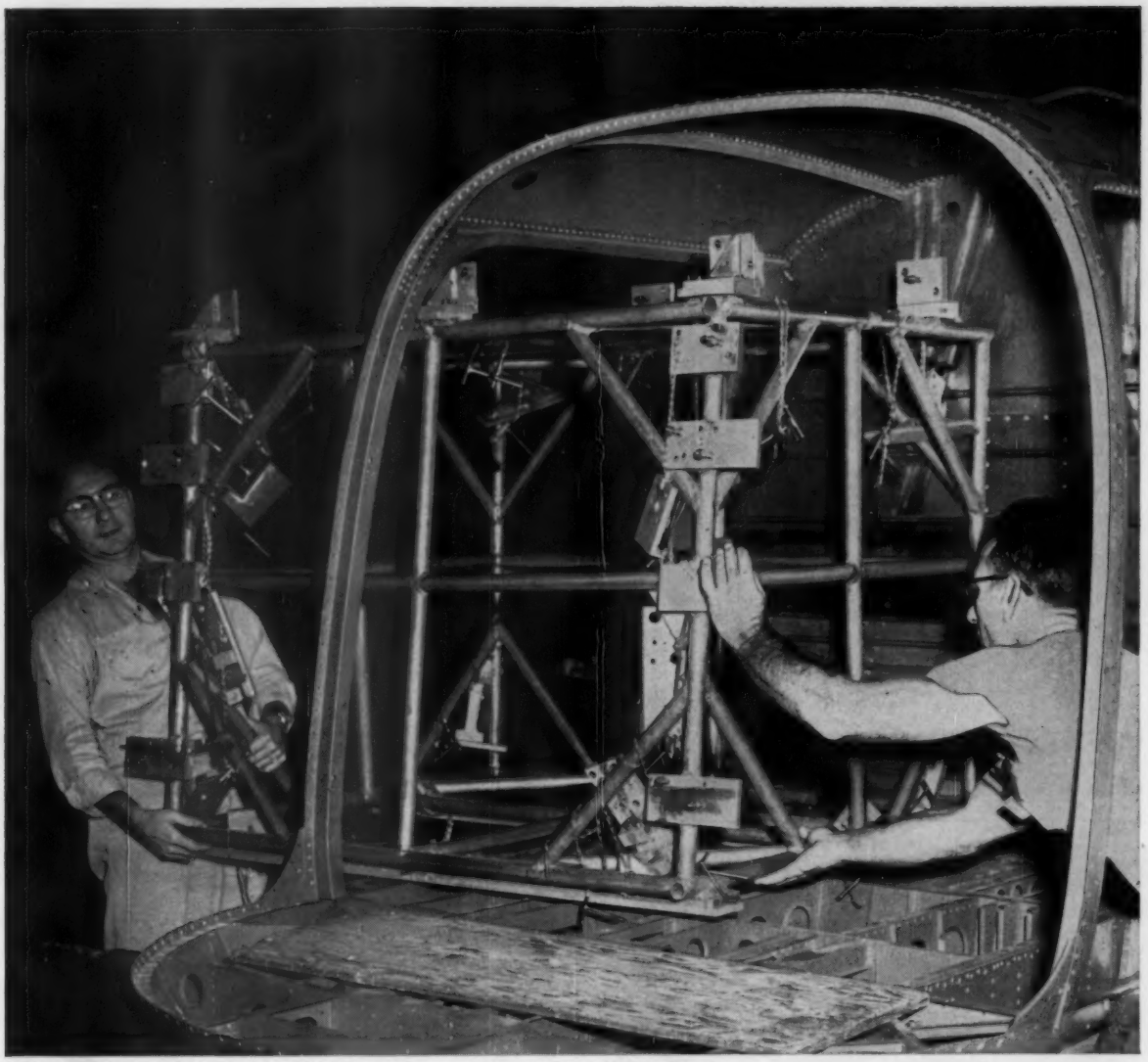
cost problems? *better check . . .*

BEATTY METAL WORKING EQUIPMENT



Take the high costs out of "short order" punching — save up to 75% on some metal fabricating jobs with these versatile Beatty punches, featuring built-in adjustable tools. **GUILLOTINE BEAM WEB PUNCH** (left) has 6 individually controlled punching units with automatically synchronized punch and die. Handwheel on **GUILLOTINE BEAM FLANGE PUNCH** (right) changes punching centers and synchronizes punch with die. Four punching units. Spacing tables supplied for either machine.

Write: BEATTY 948 150TH ST., HAMMOND, IND.



TWO MEN can easily maneuver this lightweight magnesium tool out of the cabin.

Magnesium for accuracy

"Light magnesium tool helps precision-build Bell 'copters"

"Various parts and sub-assemblies of a helicopter cabin must be precision located in order to achieve accurate assembly results," says Mr. C. D. Riley, supervisor of standards in tool design, Bell Aircraft Corporation.

"To assure accuracy, we use a supporting tool frame to hold the various parts in position while being joined. So we built the supporting frame of magnesium. Weighing only 112.5 lbs., it meets our every requirement for accuracy.

"A steel or aluminum frame weighing as much as 300 or 400 lbs. would deflect the floor of the cabin beyond the allowable limits of plus or minus .010 inch at critical attach points resulting in poor fitting of doors, plexiglas bubble and other components." For information on weight-saving, readily welded magnesium tooling plate and extrusions, contact your nearest supplier of Dow Magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 1415X.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Michigan • Fullerton Steel and Wire Co., Chicago, Ill. Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. Vinson Steel and Aluminum Co., Dallas, Texas.

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ARE YOUR
MICRO-
MACHINING
METHODS?

USE THE PERFECT COMBINATION
For Assured Accuracy
in MICRO-DRILLING

LEVIN®
SUPER PRECISION COLLETS

Super precision collets for jewelers type lathes. Ideal for holding micro-drills or other parts where concentricity is important. Available from stock in complete range of sizes from .004" (.1 mm) to 5/16" (8.0 mm).

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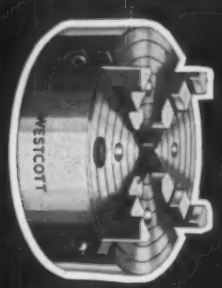
HIGH SPEED STEEL • MICRO-DRILLS

Drills from .0016" to .0591" are stocked in increments of .0004" (.01 mm). From .0610" to .1181" in increments of .0020" (.05 mm). Left hand micro-drills for use on Swiss type automatic screw machines. Short flute center drills. Send for Bulletin "Q" listing complete line of drills or Catalog M listing collets as well as full line of instrument lathes and accessories.

LOUIS LEVIN & SON, INC.—3610 S. BROADWAY—LOS ANGELES 7, CALIFORNIA



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- Competitively Priced for Highest Quality
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- Guaranteed, Trouble Free, When Properly Mounted and Used.

Westcott lathe chucks have maintained finest quality for nearly a Century. Buy from your Industrial Distributor. Write Dept. 2-A for free Catalog.

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Heavy Duty
QUICK ACTION
TOGGLE CLAMPS
Extra CLEARANCE
Extra SPEED
and now
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SERVICE
assured by the use of
HARDENED PINS
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at all bearing points, in the popular C-100, CQ-1100, and CQ-800 series Toggle Clamps.
Rugged construction—drop forgings, cast steel and solid bar stock.
Wolverine Toggle Clamps also available in several types and sizes of Standard Action and Push Action units.

Write for Bulletin
WOLVERINE TOOL CO.
1484 E. WOODBRIDGE
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Jet-age assignments for production engineers. . . .

FOR WEAPONS THAT TRAVEL FASTER THAN SOUND THE PAY-OFF IS MEASURED IN INCHES PER HOUR

Production time is as important as operating speed in the development of complex aerial weapons. This is a consideration that's built into Chance Vought's missiles and fighters. From the time they are conceived, *producibility* is a determining factor in their development. This is due largely to the influence of Vought's production engineers. Their work begins in Preliminary Design, where they translate initial drawings into an efficient manufacturing pattern. From then on their influence is continuous — in material selection, fabrication methods, shop loading and quality control. In fact, it's a production engineer who issues final company approval of every Vought weapon.

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For quality control engineers, tool engineers, manufacturing control engineers, industrial engineers . . .

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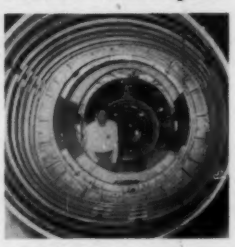

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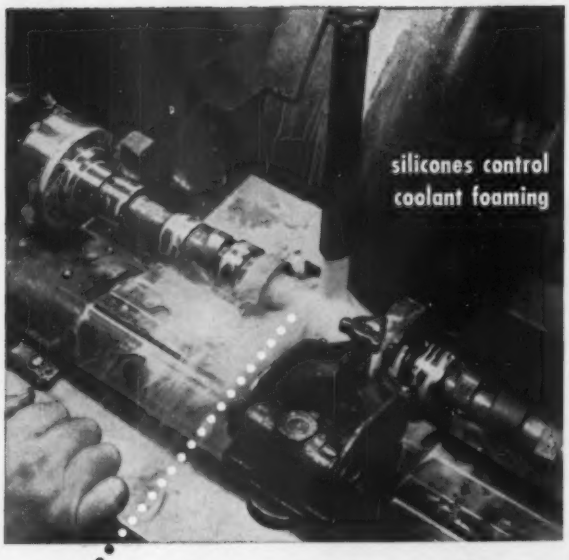

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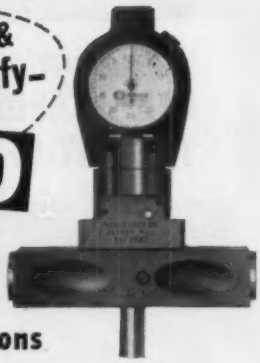

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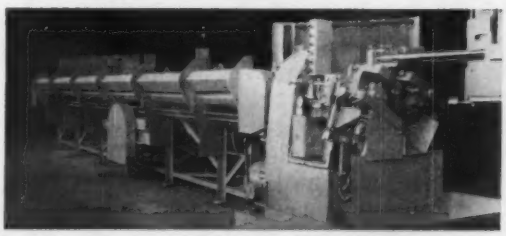

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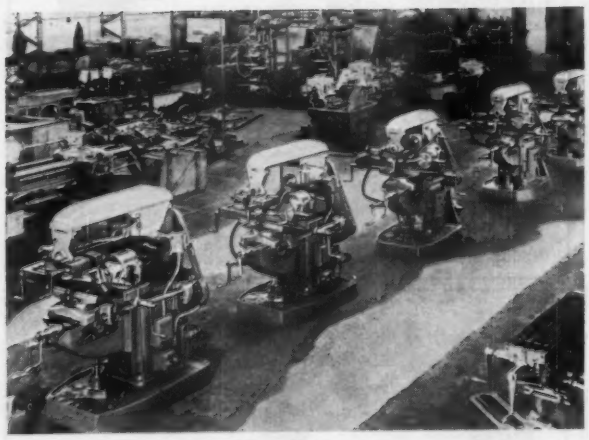

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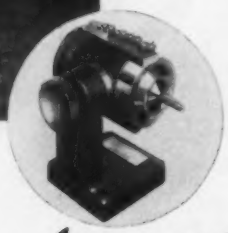

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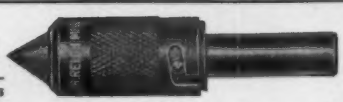

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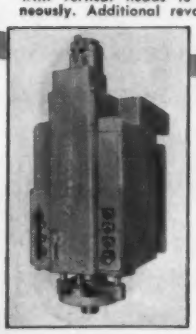

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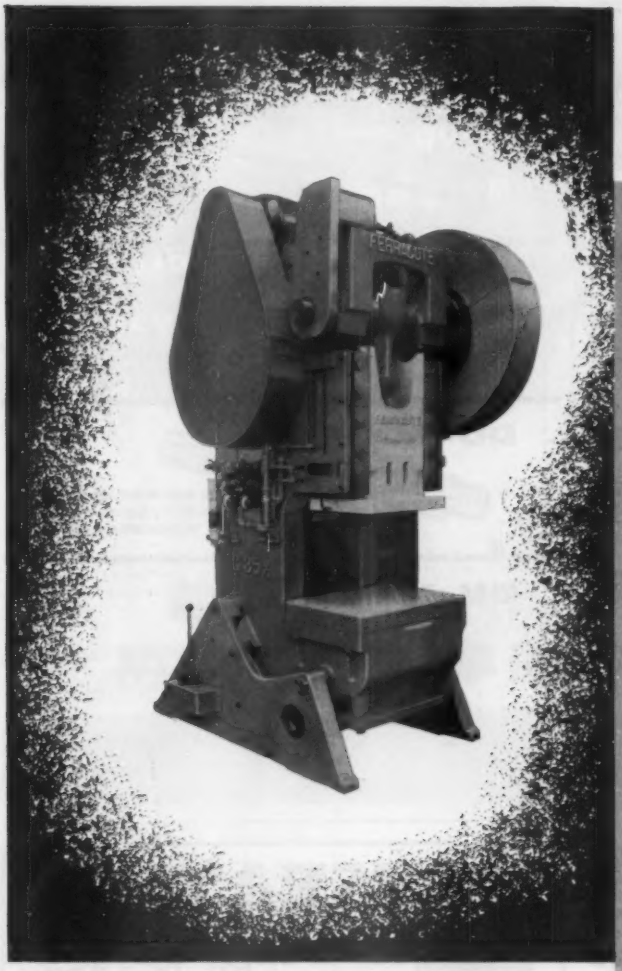

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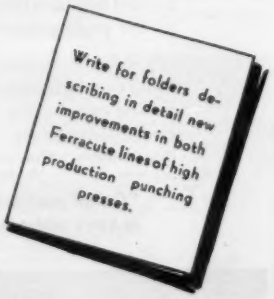

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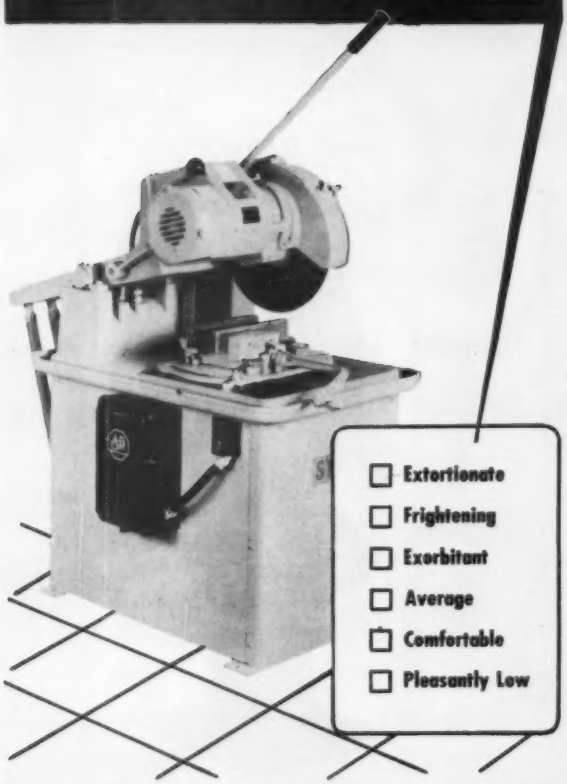

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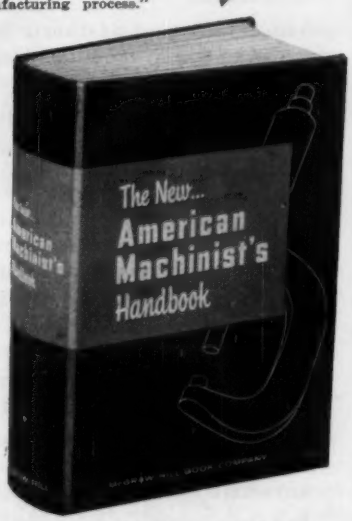

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Gaging . . .

the Surplus Machinery Market

No further word yet on the bill to speed amortization of used as well as new machine tools and equipment. Five separate bills were introduced January 7 in the Senate by Chairman John Sparkman (D, Ala) of the Senate Small Business Committee. They are similar to the recommendations made by the administration's Committee on Small Business.

Accelerated tax amortization for used equipment, as well as new, is the objective of one of the bills: permitting buyers of used equipment to write off up to $50,000 a year of taxable income for purchase of used machinery and other equipment.

Alternatively, the buyer could take a $250,000 exemption spread over a five-year period in any ratio. Not only would this be a real shot-in-the-arm for the used machinery dealers, but for the small manufacturer who just can't afford expensive new machinery and equipment.

Actually, Senator Sparkman has introduced five separate bills designed to benefit the small businessman, and directly or indirectly, the used machinery and equipment dealer.

The other four: (1) a bill to set a new graduated rate of corporate taxation on income up to $100,000 a year, (2) a bill to allow family-held businesses to take longer to pay estate taxes, (3) a bill to allow unincorporated business stockholders to share in pensions, trusts, profit-sharing and other tax-exempt plans, and (4) a bill that would allow small corporations with no more than 10 active stockholders the option of being taxed as partnerships.

Business is not all beer and skittles these days and the rosy optimism expressed by most dealers over 1957 prospects is starting to wear a little thin. Consensus of dealer reports shows that beginning-of-1957 business is down considerably from year-ago levels—and that '57 could well wind up behind 1956 business.

Sales at the moment are spotty, with some dealers reporting a slight early-in-the-year pickup, and others claiming things are anywhere from fairly slow to very slow.

But almost without exception dealers we have talked to are revising their onetime optimistic outlook for 1957. Most of them think the first quarter will be middling to good, but after that they expect business will taper off as the year goes on.

In fact one dealer is afraid he's going to be caught with a big inventory in the second half, when he expects low sales.

Why expect a slowdown? One Midwest outfit claims we can look forward to a tighter used machinery market, tougher competition and lower sales this year than last because many of the small-to-medium-sized plants that make up the bread-and-butter accounts of the used machinery dealer have completed their expansion and modernization programs and thus will be out of the market for some time to come. This, he says, is to be expected—in fact, it's a historical pattern.

But maybe it's an ill wind that blows no good—for the first time in many, many months, dealers are reporting that it's getting easier to buy used machines for stock, even some of the much-in-demand top-quality jobs.

Best sellers today: late-model turret and engine lathes, milling machines and radial drills.

United
EVERY TIME!

AUTOMATICS
B & S 00G—Slotting
B & S 0G Vert. Slide—Mag. Feed—1949
CLEVELAND MODEL A 1-1/16" Single Spindle

BOREMATICS
HEALD 48A Single End
HEALD 49 Double End—4 Heads
EXCELLO 2112A Single End

VERTICAL BORING MILLS
BULLARD 24" New Era—3-Jaw Chuck Table
BULLARD 42" — Spiral Drive — 4-Jaw Chuck Table

SURFACE GRINDERS
ABRASIVE 3B 8" x 24" Hor. Auto.
COVEL #20 6 x 18 Hor. Hydr.
DoALL D6 6 x 18 Hor. Hydr.—Selectron —Coolant—1953
NORTON 6 x 18 Hor. Hydr.
NORTON 6 x 18 Vert. Hydr.
THOMPSON Model F 6 x 18 Hor. Hydr.

ENGINE LATHES
AMERICAN 12" x 30" High Duty 12-Speed
AMERICAN 36" x 60" High Duty 12-Speed
REED-PRENTICE 20" x 78" 16-Speed

PROFILERS
P & W 12B M-1639 2-spdl. Vert.-Col. Raised 12"
P & W M-1482 30" 2-Spdl. Vertical

TURRET LATHES
B & O #7 2½" Ram Chucker
GISHOLT #3 1½" Ram—Bar or Chucker
GISHOLT #4 2" Ram—Bar or Chucker
GISHOLT #5 2½" Ram—Bar or Chucker
GISHOLT 2L 3½" Saddle — Taper — Threading
W & S #2 1" Ram—El. Bar Feed
W & S #3 1½" Ram—Chucker
W & S #4 2" Ram—Bar—Preselect.
W & S #5 2½" Ram—Bar Preselect.

MILLERS
B & S #2 Light Type Plain
B & S #3B Standard Plain — Vert. Attach.
K & T 3H Vertical—Power Feed to Head

PRODUCTION MILLERS
CINN. 08 Plain
CINN. 08 R & F—1951
CINN. 1-18 Plain
CINN. 2-24 Plain
CINN. 4-36 Hydromatic—2-way cycle

PLANERS
GRAY 36 x 36 x 12' Double Housing—1 Rail—2 Side Heads—1942

PLANER MILLERS
INGERSOLL 42 x 42 x 14' Adj. Rail Double Housing — 2 Swivel Side — 2 Swivel Rail Heads—1940

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#100-10	10' x 8 GA.	12' Bed
#150- 8	8' x 5/16"	10' Bed
#150-10	10' x 1/4"	12' Bed
#150-12	12' x 3/16"	14' Bed

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5' arm 14" column Carlton factory motor drive with motor

No. 5 Abrasive 14"x60" surface grinder, horizontal spindle, motor-in-base.

No. 2 Standard Brown & Sharpe vertical mill, new 1943. Timken Bearing, fine tool.

No. 3 Gisholt ram type universal turret lathe, new 1942. 5 HP motor drive.

No. 5 Gisholt ram type universal turret lathe, new 1940. Arr. bar & chucking.

Model BL2416 P&W Keller machines (2) one late 3 spindle, one single spindle.

No. 5-48 Cincinnati hydromatic duplex mill, late 20 HP motor.

No. 34-36 Cincinnati hydromatic duplex mill, tracer, new 1940.

No. 4 Gallmeyer & Livingstone universal tool & cutter grinder, new 1941.

24" Western "Steptoe" heavy duty Timken Bearing Motor drive shaper.

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BROACHES

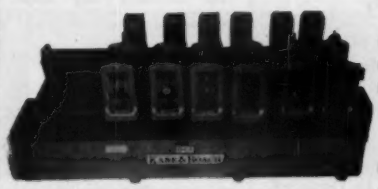
CINCINNATI No. 1-30 Stroke Vertical Duplex; hyd.
COLONIAL Model VGI 10-48 Stroke Vertical, hyd.
LAPOINTE No. 3 Double Spindle, M.D.
LAPOINTE Model SRV 10-54 Stroke Vertical; hyd.
LAPOINTE SRV 15/66" Stroke Vertical hyd., late

DRILLS, RADIAL

AMERICAN 7' arm 16" Column Plain; motor drive
CINCINNATI BICKFORD 4' arm 11" Column Plain; "Super Service"; motor on arm
CINCINNATI BICKFORD 5' arm 13" Column Plain
CINCINNATI BICKFORD 6' arm 17" Column Plain, "Super Service" motor on arm
MORRIS 3' arm 11" Column Plain; late type

GEAR EQUIPMENT, MISCELLANEOUS

BILGRAM 6" Bevel Gear Generator; 1 D.P.; M.D.
BILGRAM 16" Bevel Gear Generator; 2 D.P.; M.D.
BROWN & SHARPE No. 13 Straight & Bevel Auto. Gear Cutter; 18" cap., 4 D.P., M.D.
CINCINNATI No. 4 Auto. Gear Cutter; cap. 36"; 2½ D.P.; late type
CINCINNATI No. 6A Auto. Gear Cutter; cap. 72"; 1½ D.P.; late type
CROSS No. 1 Gear Tooth Rounding Machine; cap. 4 pitch or finer to 24" dia.; 2 pitch or finer to 6" dia.
CROSS No. 40 Gear Tooth Pointing & Chamfering Machine; gear face 10", gear dia. 20"
CROSS No. 45 Gear Chamfering Machine; late type
DETROIT Type GG-35 Gear Grinder; late type
GOULD & EBERHARDT No. 368M; 3-Spindle Gear Rougher; 2 D.P.; M.D.
GOULD & EBERHARDT No. 368T Gear Rougher; 4 D.P.; M.D.
MICHIGAN Model 862-24A Gear Finishing Machine
MICHIGAN Model 854 Rack Type Gear Shaver; 8" dia.; 2" Face; M.D.
PRATT & WHITNEY 10" Gear Grinder; single wheel type; cap. 10-11/10"
ROBEY SMITH No. 1 Straight Bevel Gear Planing Machine; M.D.
SHEFFIELD (Cimatool) No. 201A Auto. Burring Machine; late type



KANE & ROACH "Ohio" Cold Roll Forming Machine; late type.

GEAR EQUIPMENT—HOBBING

BARBER COLMAN Type A; cap. 12"x12" 3 D.P.
BARBER COLMAN Type B Auto. Gear Hobbing Machine No. 1 1" dia. Steel 24 D.P., steel 32 D.P.
BARBER COLMAN Type T; 12"x12" cap.; 3 D.P.
BARBER COLMAN Model 8-10 Model (type V) Vertical; cap. 8"; 4½ D.P., late type
BARBER COLMAN No. 17 cap. 8"; 2½ D.P.; M.D.
GOULD & EBERHARDT No. 8H Universal; cap. 12"; 4 D.P., M.D.
GOULD & EBERHARDT Model 24-H Universal 27" cap; 3½" D.P. late type
GOULD & EBERHARDT 12H Heavy Univ. cap. 12"; 4 D.P., M.D.
KOEPFER Model WM-11 Automatic Gear Cutter; 24 D.P., late type

GRINDERS, PLAIN CYLINDRICAL

CINCINNATI 4"x12" Centers Model OH "Filmatic"; New 1958
LANDIS 4"x12" Centers Type H Hyd., late type
LANDIS 6"x16" Centers; M.D.
LANDIS 10"x36" Centers Type DC Heavy Hyd.
LANDIS 10"x36" Centers; M.D.
LANDIS 10"x72" Centers Type DC Heavy Hyd.
LANDIS 10"x96" Centers Type C Hyd., late type
LANDIS 16"x120" Centers, Type B; late type
NORTON 4"x12" Centers Type CTU Hyd., 1951
NORTON 10"x18" Centers Type C Hyd.; late type
NORTON 10"x36" Centers; Motor Drive
NORTON 10"x48" Centers Type C Hyd.; late type
NORTON 14"x72" Centers Type C; late type
NORTON 14/22"x36' Centers Type C "Gap Type"
NORTON 16"x48" Centers Type C; late type

GRINDERS, SURFACE

HEALD No. 22 Rotary Surface Grinder 12" Chuck
HEALD No. 25A Rotary Surface Grinder 30" Chuck
MATTISON 14"x16"x60" High Power "Precision" Hyd.; late type
MATTISON 14"x24"x72" High Power "Precision"
NORTON 6"x18" Horizontal Spindle Hydraulic; late
NORTON 6"x18" Vertical Spindle Hydraulic; late
PRATT & WHITNEY 14"x36" Vertical Spindle Hydraulic; late type
GALLMEYER & LIVINGSTON No. 45 cap. 12"x24"

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LATHES, TURRET

GISHOLT No. 1L Univ. Saddle Type; Swing 19"
GISHOLT No. 2L Saddle Type Swing 22⅝"; cross sliding turret; late type
GISHOLT No. 4 Ram Type; Swing 30"; late type
GISHOLT No. 5 Univ. Ram Type Preselector Head; Swing 19¾"; late type
LIBBY (INTERNATIONAL) Model 4H-12 Saddle Type; Swing 32"; cross sliding turret
MOREY No. 2 Ram Type; Swing 14"; late type
MOREY No. 3 Univ. Ram Type Swing 16½"; late type
MOREY No. 4 Univ. Ram Type Swing 19½"; late type
WARNER & SWASEY No. 1 "Electric"; swing 11"
WARNER & SWASEY No. 1A Univ. Saddle Type; Swing 18"; late type
WARNER & SWASEY No. 2A Univ. Saddle Type; Swing 21¼"; late type
WARNER & SWASEY No. 3 Ram Type; Swing 21¼"
WARNER & SWASEY No. 4 Univ. Ram Type Preselector Head; Swing 18¼"; for Bar or Chucking

MILLERS, PROFILE AND DUPLICATING MACHINES

MOREY 12M 2 spindle Vertical Profiler & Miller; table 12"x15"; late type
PRATT & WHITNEY GG "Keller" Auto Toolroom Machine; table 16"x16"; late type
PRATT & WHITNEY Model BL-2416 "Keller" Auto Tracer Control Miller; 3 dimensional; 3 spindle; 22"x42"; late type

PLANERS

DETRICK & HARVEY 48" x 48" x 16' Double housing; Hyd.; 4 heads; M.D.
GRAY 48" x 48" x 10' Double housing; 4 heads; D.C.; M.D.
LIBERTY 144" x 76" x 48' Convertible openside; 4 heads; vari-voltage
NILES 48" x 48" x 16' Double housing; 4 heads; D.C.; M.D.
NILES BEMENT POND 60" x 60" x 14'; Double housing; 4 heads; D.C.; M.D.
NILES BEMENT POND 72" x 72" x 30' Double housing; 4 heads; vari-voltage; M.D.
NILES BEMENT POND Horizontal, 30" x 30" x 14' Double housing; 4 heads; M.D.
SELLERS 48" x 48" x 14' Double housing "Power-Flo"; 4 heads; D.C.; M.D.
SOUTHWARK #1 Horizontal Plate Edge; cap. 1½ x 16 ft.; M.D.

SCREW MACHINES, AUTOMATIC BAR OR CHUCKING

BROWN & SHARPE No. 00G—Auto. Cap. ⅝" Round; late type
CLEVELAND 1¼" Model A Single Spindle Auto.
CLEVELAND 3¼" Model A Single Spindle Auto.
CLEVELAND 7⅛" Model A Single Spindle; Auto.
CONOMATIC 1⅞" 8-Spindle Automatic; late type
CONOMATIC 4⅝" 4-Spindle Automatic; late type
NEW BRITAIN GRIDLEY Model 65 — 6-Spindle Automatic Chucking; late type
GREENLEE 1-5/8" Six-Spindle Automatic; late type
GYROMATIC "TAVANNES" No. 40 6-Spindle Auto.
CONOMATIC 1⅝" 6-Spindle Automatic; late type
CONOMATIC 1⅝" 8-Spindle Automatic; late type
CLEVELAND 1¼" Model A; 4-Spindle Automatic
CLEVELAND 2½ Model A; Single Spindle Auto.
GREENLEE 1⅝" 6-Spindle Automatic; late type

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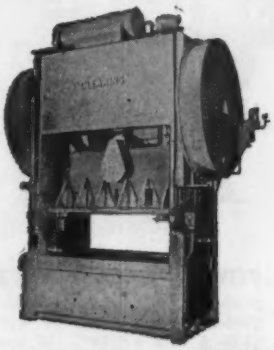

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*1⅝" New Britain, 6 Spdl. Ser. 29525 w/Tooling
*1½" Acme Gridley, 6 Spdl. Ser. 70804 w/Tooling
*9/16" Acme Gridley, 6 Spdl. 22000 Series (4)
*2G Brown & Sharpe Ser. 10885 w/Tooling
*0G Brown & Sharpe Ser. 10,997 & 11183 w/Tooling
*00G Brown & Sharpe Ser. 20005 w/Tooling

CHUCKER

*#675 New Britain 7½" Hydr. chucks, 6 spdl.
*#14 New Britain 6¾" Hydr. chucks, 4 spdl.

GRINDERS

*6x18 Parker Majestic Surface, Precision, Complete (1953)
*16A2 Blanchard 2 spdl. Autom. Surf. '48
*72A Heald Intern. T.R. Mod., Cr. Feed Head & T. Stock '42 Rebuilt Cond.
*2 Cincinnati Centerless, In & thru feed (1943)
*4x12 Landis Type H, Hydr w/infeed, Timer, Cycling (1944)
*8x12 Landis Type H, Hydr w/Hydr Collet attch. 90° Swivel head (1944)
*12x36 Cinc. Univ. Filmatic '40 Like Rebuilt

LAPPERS

*Cinc. Centerless Lapper, Filmatic '51, like new.

LATHES

*20x84 Sidney H.D. 32 speed T.R. Mod. '52
*8 Sundstrand Autom., F.&R. Slides, T. stock '42
*8A Sundstrand 12" swing with F.&R. Slides '52
*8x21 Fay Autom. w/F.&R. Slides '44
#3 W&S Univ. Turret, 12 speed Ser #448293—'37
*#5 W&S Ram Type Turret, 2 Speed Ser. #839379
*4A W&S Turret, C. Feed Turret Ser #874000

MILLS

*2H K & T Vert., Micr. Steps, 5 HP, '42
*#2 B & S Plain Horiz. w/v. head, 3 HP, '45
*0-8 Cinc. R&F Prod. 12" Feed (new)
*2-24 Cinc. Simplex, Prod. '50 mod.
*34-48 Cinc Hydromatic Simplex, w/Tracer
*OT 50 Lees Bradner Univ. Thread Mill '44

PRESS

*200 Ton Rodgers Hydr. 30" str, 30x30 bed

SHAPER

*36" Rockford Open Side, S. & R. heads '43

SAW

*16x11 Peerless "Hydracut" Hack, 20' barfeed '48

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61" Bullard Maxi-Mil, 2 Rail Hds.
53" Niles, 2 Rail Hds.; P.R.T.; M.D.
36" & 24" Bullards, Spiral & New Era (3)
GRINDERS No. 36 Hanchett 36" vert. Rotary '44
30" Blanchard No. 16 Vert. Rotary
36"x42" Pratt & Whitney Vert. Surf. '47
60" Hanchett Vert. Spin. Surf. No. 300, Rec. 10"x20" B. & S. No. 1 Univ. '42.
LATHES 25" x 48" cen. LeBlond, 31" sw. '41.
36"x21' Cen. N.B.P. Grd. Hd., M.D.
16"x78" Cen. Sidney, T.A., 18½" SW., '52.
TURRETS No. 3AL, 2L, 5 & 3 Gisholts.
Nos. 2 W. & S. & 2 & 2G Mereys
MILLERS No. 2 Cinci. Dial Type Univ. '45.
No. 4B K. & T. Vert.—Table 102"x19" oversize.
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9/16" Cleveland Model A, m.d., 1943
Model B 1-1/16" Cleveland, m.d.
4 spindle 1⅝" Cleveland, Model M., m.d.
4 spindle 2" Model K Cleveland, m.d.
4 spindle Model RAS National Acme—Acme Gridley, 2" cap., m.d.
2" Cleveland Model A, single spindle, m.d.
2½" Cleveland, m.d., Model A
No. 8A Cleveland, m.d., 8" cap., latest
No. 4D Potter & Johnston, m.d.
No. 5 DELX Potter & Johnston, m.d., late

BOLT THREADERS

Victor Nut Facing Machine, m.d., cap. ⅜" to 2" nuts
1½" Landis 2 spindle, m.d.
1½" Landis 4 spindle, m.d.
1½" Landis Stay Bolt Threading Machine, Double Head, m.d.
No. 326 Oster Bolt & Pipe Threading Machine, m.d.

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No. 1 Cleveland Horizontal Boring, Drilling & Milling, m.d.
5½" bar Betts Floor Type, m.d.
5½" bar Niles-Bement-Pond, m.d.
6" bar Sellers Floor Type, m.d.
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Floor Plates—all sizes

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42" Bullard New Era, m.d.
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48" Niles-Bement-Pond Car Wheel Borer, m.d.
53" Niles Heavy Pattern, m.d., p.r.t.
53" Niles Heavy Pattern, vee belt m.d., latest
102" Niles Wheel Turning Boring Mill

BROACHING MACHINES

75 H.P. LaPointe Hydraulic Broach, m.d.
12x72" Thompson Automatic Flat Broach, m.d.
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Type SBD-42-6 American Vertical Hy. Dup. Broach
Type SBD-48-15 American Vertical Dup. Ram Surface Hydr. Broach
No. 3 Diligear Hydraulic Broach, type XA, 54" stroke, m.d.

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5'-14" col. American Triple Purpose, m.d.
5'-14" col. Carlton, m.d.
5'-15" col. American, m.d. on arm
6'-17" col. American Triple Purpose, m.d. on arm
7'-16" col. American Triple Purpose, m.d.
8'-17" col. Dreses, gear box m.d.
Baush Radial Drilling & Tapping Machine, m.d.

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No. 4 Fosdick, 8" overhang, High Speed, m.d.
No. 15 Buffalo Floor Model, m.d.
No. 1½, 1 & 2 Avey, m.d.
No. 1½ Avey MA-8, m.d.
No. 1B Edlund, m.d., new
No. 4BM Fosdick, single spindle, H.S., m.d.
1 spindle No. 2MA6 Avey High Speed, m.d., 7½" overhang, 1943
No. 2B—8" H.D. Edlund H.S., m.d.
2 spindle Alion, belted m.d., 8" overhang
2 spindle No. 2 Avey High Speed, belted m.d.
2 spindle No. 2B MAI Avey Production Type, m.d.
2 spindle Avey, size No. 1, Type B, Style VHP, m.d., 8" overhang
2 spindle No. 3MA6 Avey High Speed, m.d.
2 spindle No. 2 Leland-Gifford High Speed, 8" overhang, m.d.
2 spindle Leland & Gifford High Speed Hydraulic Type, m.d.
No. 2LMS Leland-Gifford, single spindle, High Speed, m.d.
No. 2LMS Leland-Gifford, H.S. Hydraulic Feed, m.d.
3 spindle No. 2MA6 Avey High Speed, m.d.
3 spindle Leland & Gifford #1 LMS—High Speed, m.d., late
3 spindle Leland & Gifford High Speed, m.d.
3 spindle Delta H.S., 4 speed vee pulley drive
4 spindle Leland & Gifford, m.d. on each spindle
6 spindle Leland & Gifford, m.d. on each spindle, No. 2 taper
6 spindle No. 1 Avey High Speed, m.d.
6 spindle Model M 1613 Pratt & Whitney In Line Vertical, m.d.

HORIZONTAL DRILLS

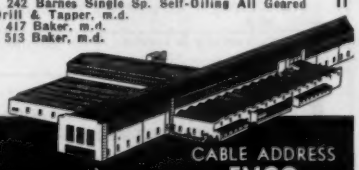
No. 2 Avey Style MA 1, with horizontal operation
3 way Natco Horizontal Drill, consisting of 3 E13 Heliounits
No. 1½ 8x50" Pratt & Whitney Gun Barrel Rifling Machine, m.d., latest
No. 1½x105" Pratt & Whitney 2 spindle Gun Barrel Rifling Machine, m.d.
No. 1 Pratt & Whitney 2 spindle Deep Hole Drill, belted m.d.
Model 410 W.F. & John Barnes, 2 spindle Hydraulic Deep Hole Drill, m.d.
Pratt & Whitney Deep Hole Sharpener, m.d.
Natco Horizontal Drill, holesteel model, m.d., 1942
Natco Horizontal Drill, 2 opposed B4F2 Heads, 1943
¾"x40" Bausch Double Horizontal Drilling Machine, m.d.

MULTIPLE SPINDLE DRILLS

No. 3 Baush, m.d., 16x30" head
3 spindle 28" Cincinnati-Bickford Upright Drill, m.d., No. 4 M.T.
No. 924 Barnes Vertical Drilling, Boring, Facing & Reaming Machine
6 spindle W.F. & John Barnes Vertical Drilling Machine, m.d.
3 spindle Rockford 12" Gang Drill, m.d.
4 spindle No. 201¼ Barnes H.D., m.d.

UPRIGHT DRILLS

20" Barnes All Geared Self-Oiling Drill & Tapper, m.d.
20" Cincinnati-Bickford Super-Service Prod. Drill, m.d.
No. 2AL Natco Holesteel Vertical, m.d.
24" Aurora, m.d.
No. 2 Colburn Mfg. Type, m.d.
No. 4—48" Defiance Machine Co. Drill, m.d.
No. 201¼" Barnes Single Sp. Self-Oiling All Geared Drill & Tapper, m.d.
No. 242 Barnes Single Sp. Self-Oiling All Geared Drill & Tapper, m.d.
No. 417 Baker, m.d.
No. 513 Baker, m.d.



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#16-36 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A3 Heald Int. Sizematic, 1944
#72A5 Heald Internal, new 1942
#72A5 Heald Bridge Type Int.
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3B Abrasive Surf. 8"x24", 1943
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12"x45" Fay Automatic
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14"x12" Fay Auto, AC MD
36"x120" Putnam Grd. Hd., MD
R14 Seneca Falls, 16"x36", 1942
120"x96' oc N-B-P, ser. 3380
#5W Cinn Acme Univ. Turret
#4 Gisholt Univ. Tur. A.C.&B.F.
#3H-10 Libby H.D. Tur. 1942
#4A W&S Turret Ser 338969
4FU Fastermatic, tur, 32" sw. 1944
8D Potter & Johnston, new 1941

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54"x60"x8' Ingersoll Openside, 1942
Davis & Thompson Vert. 1944
#12-B Pratt & Whitney Profilers
10"x60" P&W Mod. B. Thread Mill
#LT 6"x72" L B Thread Mill
#HT 12"x24" L-B Thread, 1942
#CT 24"x36" L-B Thread, 1942
No 2 Cinn. Univ. Hi-Power
#1.4 Van Norman Prod. 1942

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MISCELLANEOUS

6" Goss & DeLeeuw 8 spdls. 1941
#306 Barnes Vert. Hone, new 1942
#11RD 2 Hd. W&S Tapper, latest
#36BM G&E 3 Spdl. Bevel Gear
612-A Fellows Gr Shaper 18" cam
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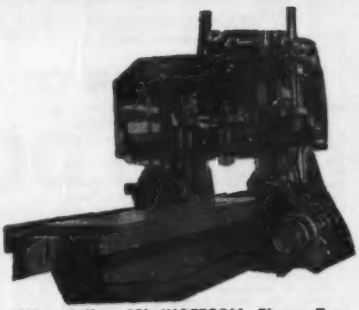

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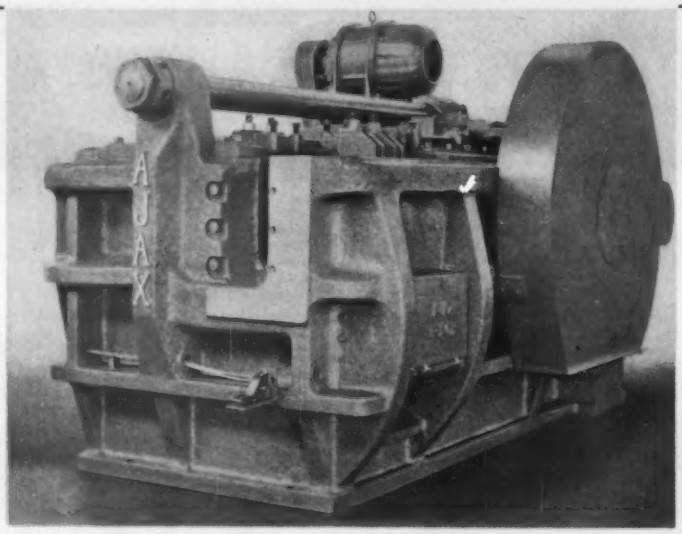

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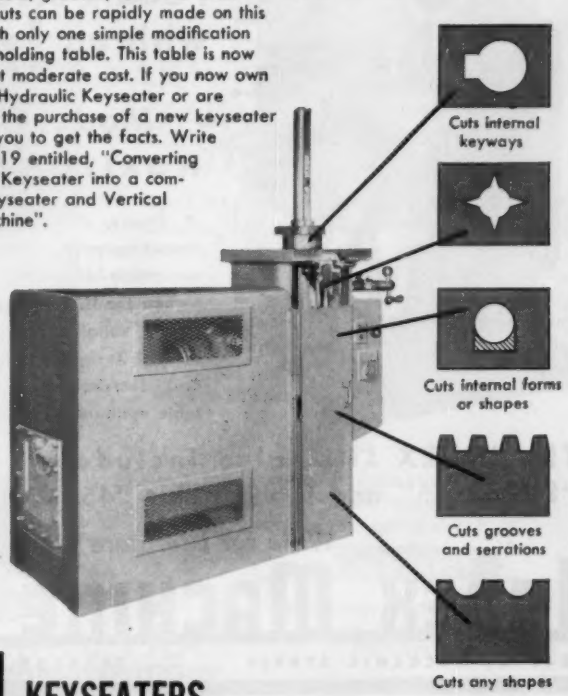

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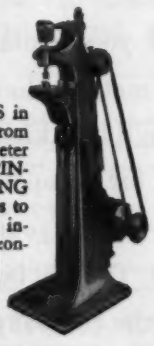

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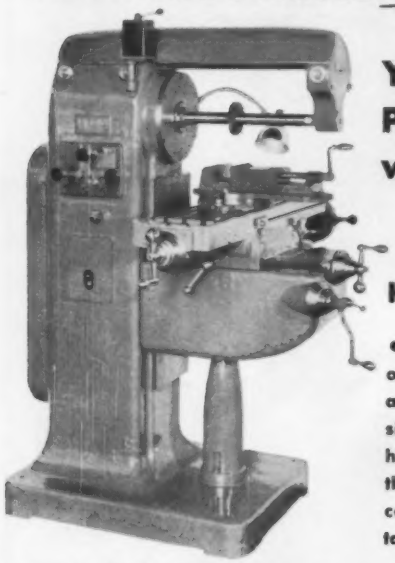

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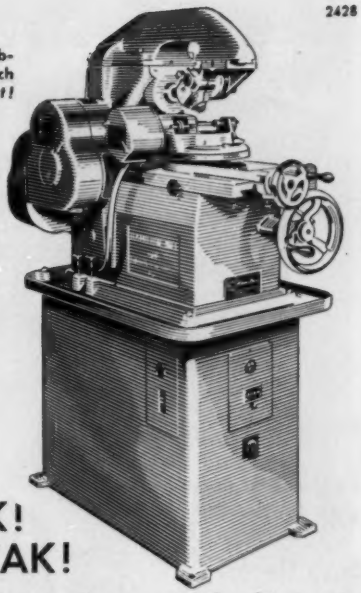

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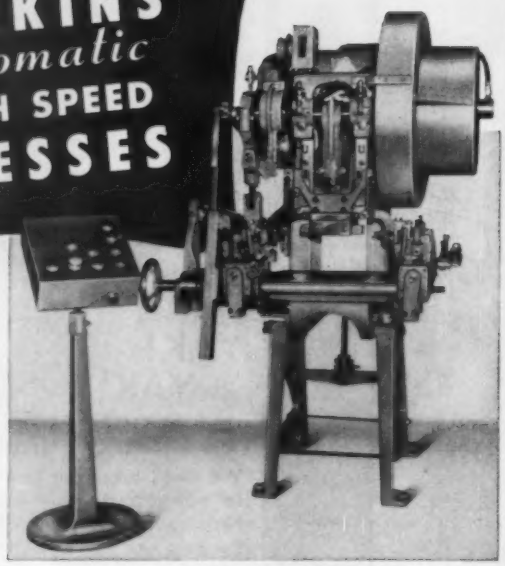

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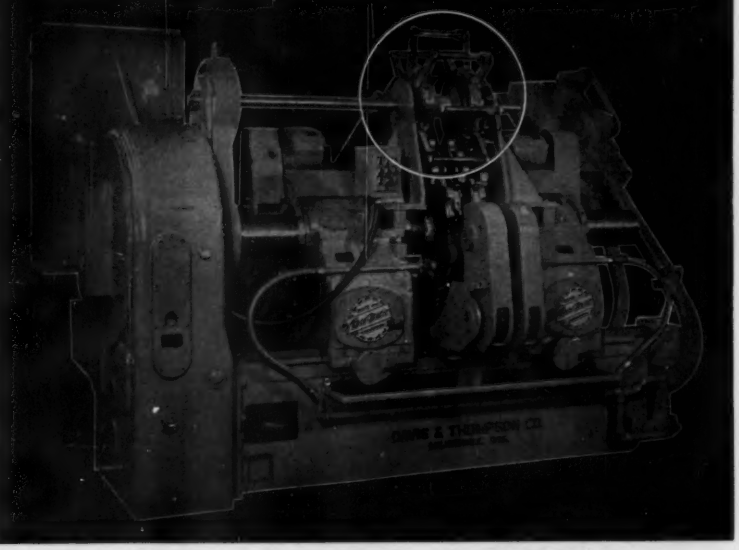
...Milling and Centering Steering Gear Shafts at the Rate of 360 Per Hour



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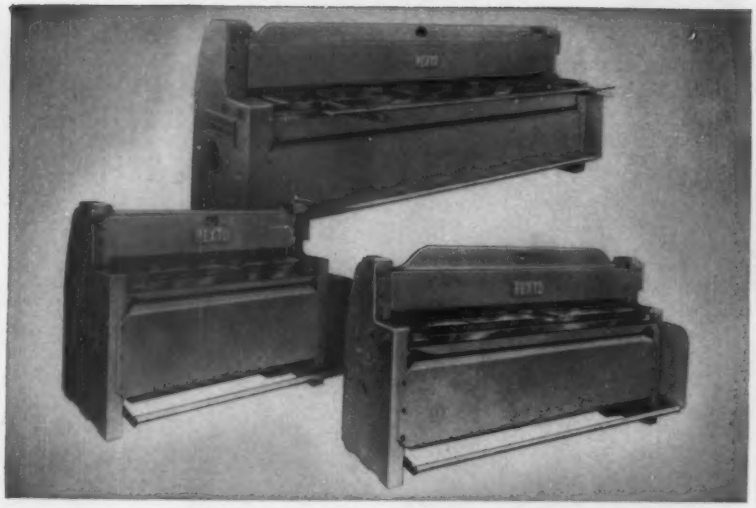

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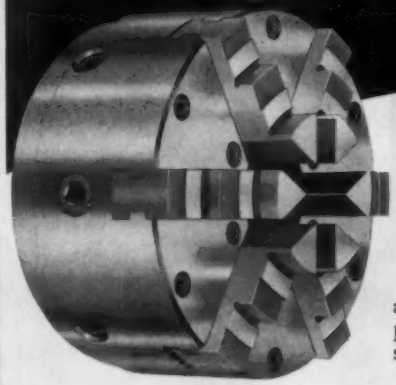

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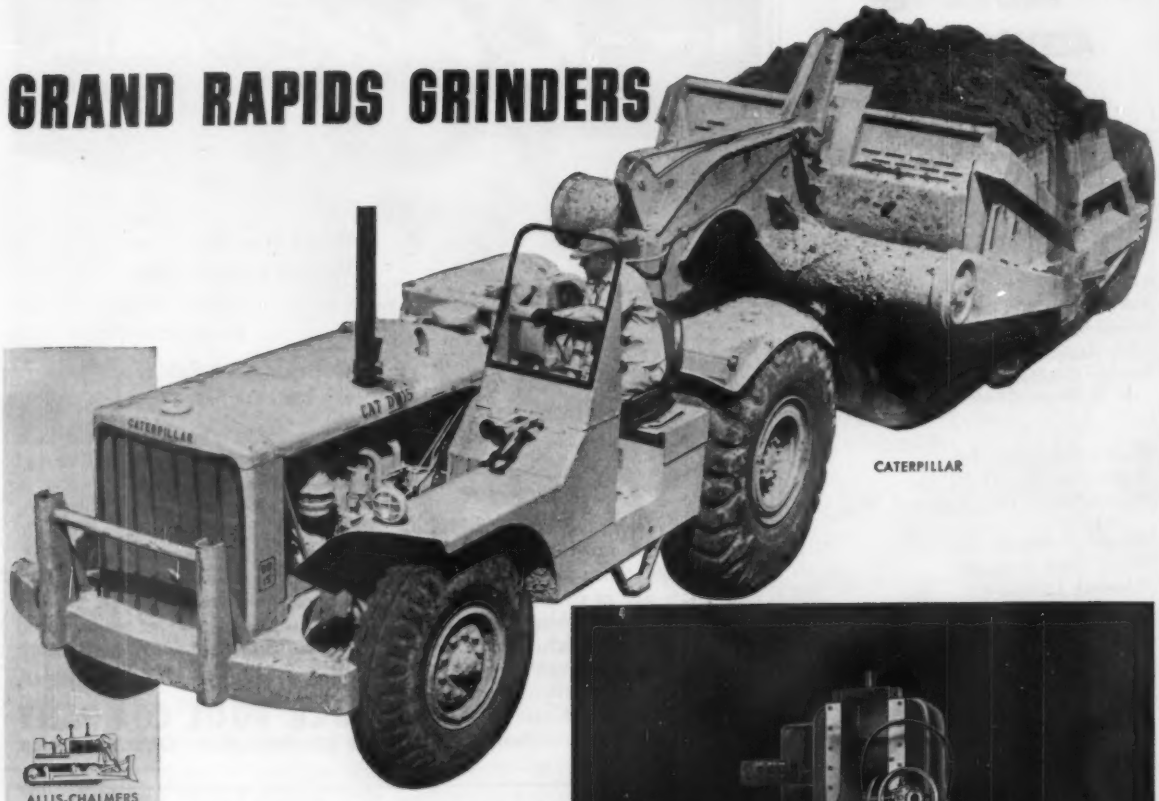

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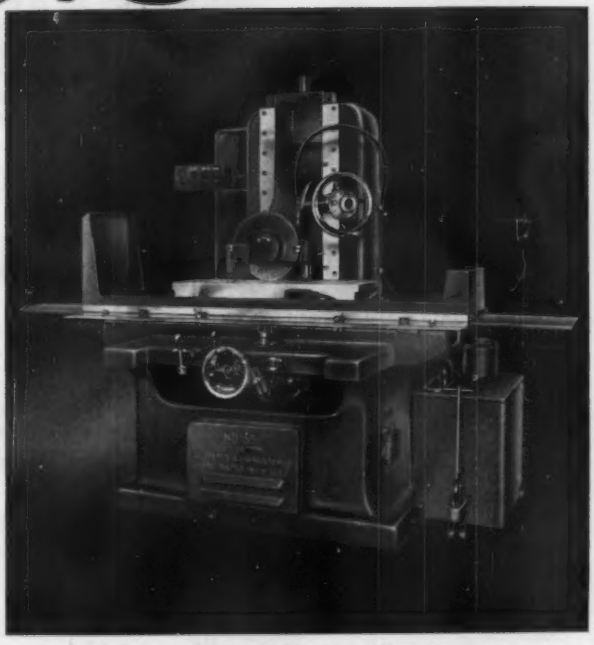

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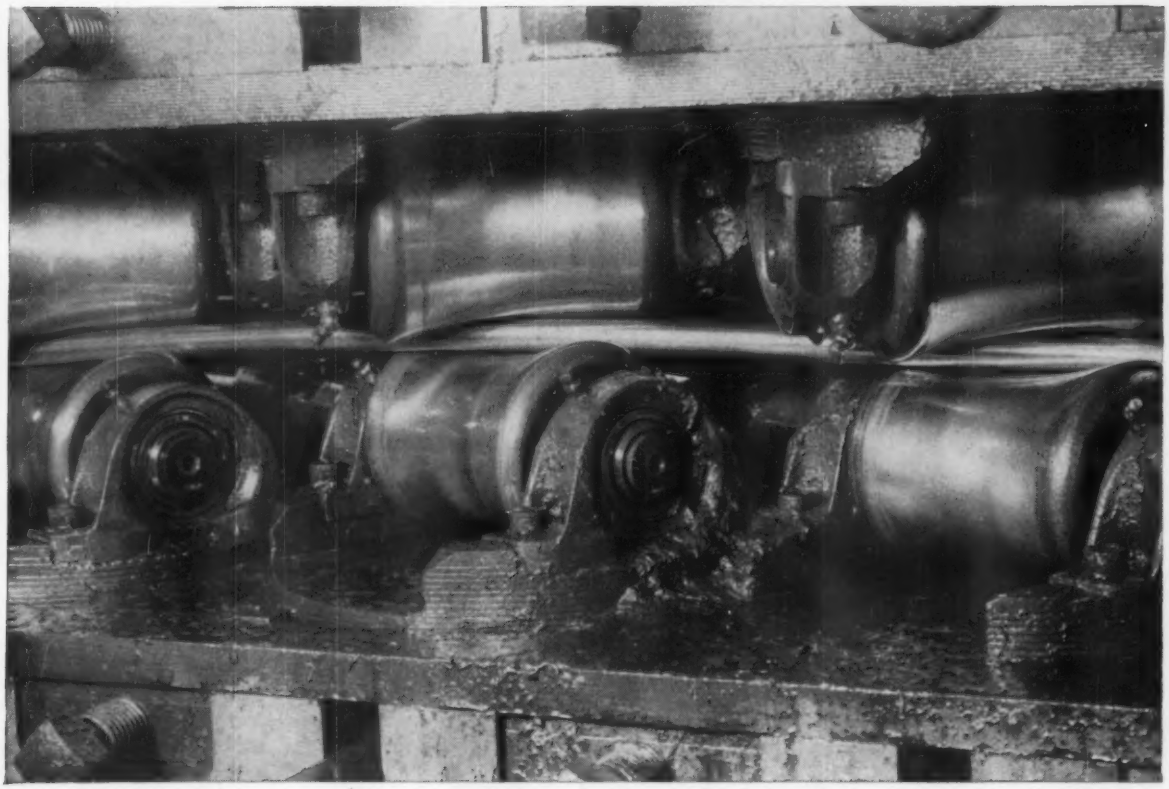
THE HOLO-KROME SCREW CORP., HARTFORD 10, CONN.

Sold only through authorized Holo-Krome distributors.



Uses tool steel that outwears others 3 to 1 for its straightener rolls

TO help its customers get the longest possible life out of the rolls used in its small tube straighteners, Mackintosh-Hemphill Division of E. W. Bliss Co. makes them from Graph-Mo® steel.

Graph-Mo contains millions of tiny particles of diamond-hard carbides. As a result, users report it outwears other tool steels on an average of three to one!

Graph-Mo steel also contains free graphite which gives it outstanding anti-friction properties, prevents pick up and scoring. This is a big advantage to users of small Mack-Hemp straighteners because it results in a better surface on the products being processed. What's more it eliminates chrome plating the rolls, which is usually necessary when the straighteners are used for non-ferrous metals such as brass.

Graph-Mo steel gives Mackintosh-Hemphill two other important manufacturing advantages. It saves machining time because it's 30% easier to machine than ordinary tool steels. And it simplifies heat treating because of its uniform response to heat treatment.

Graph-Mo is one of four graphitic tool steels developed by the Timken Company. If you want more information about their use in dies, punches, gages and machine parts, write for the new Timken Graphitic Steel Data Book. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING